Fig. 5.147 Mean bubble departure diameters for various coolant mass fluxes for stable subcooled flow boiling (a) and various imposed heat fluxes for transient subcooled flow boiling for G=300±5% kg/m²s and ΔT_{sub} =5°C with t_p=10 sec (b), 20sec (c) and 30 sec (d).

(c) Oscillation of FC-72 Subcooled Flow Boiling- Bubble Departure Diameters at $\triangle T_{sub} = 5^{o}C$, $G = 300 \pm 5\%$ kg/m²s, period=20s

○: q=6.1 W/cm²
△: q=7.5 W/cm²

(d) Oscillation of FC-72 Subcooled Flow Boiling- Bubble Departure Diameters at $\triangle T_{sub} = 5^{o}C$, $G = 300 \pm 5\%$ kg/m²s, period=30s

○: q=6.1 W/cm²
△: q=7.4 W/cm²
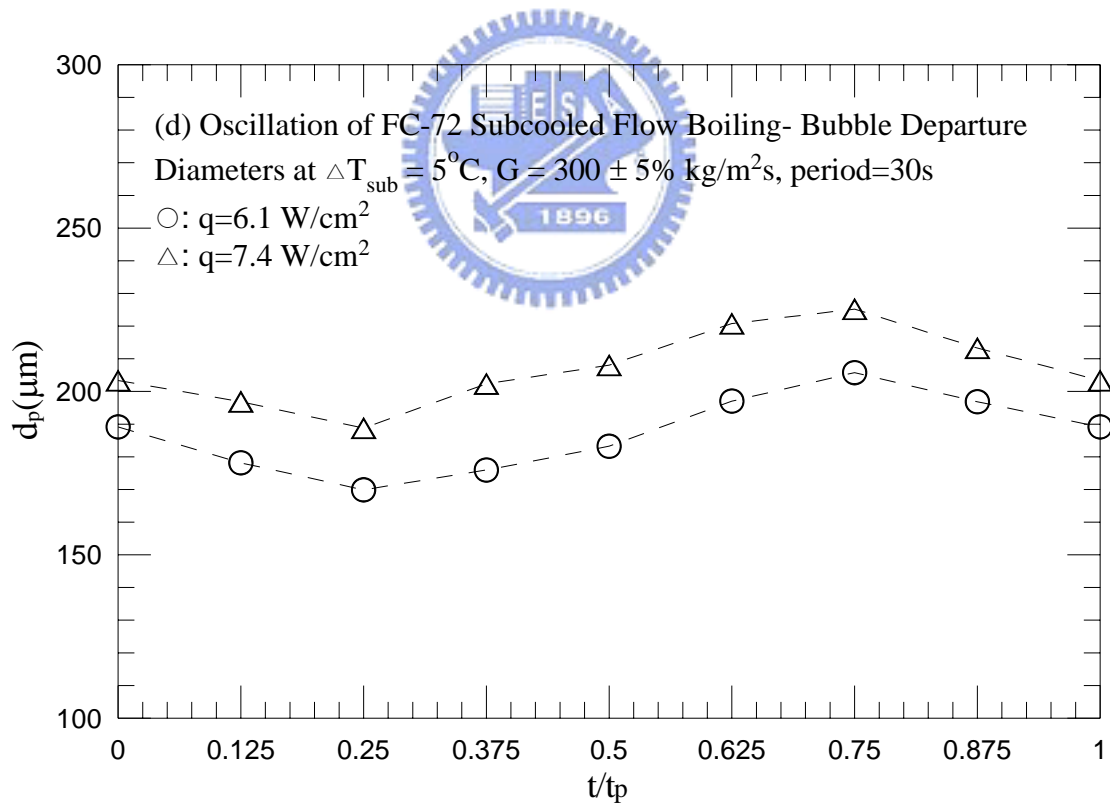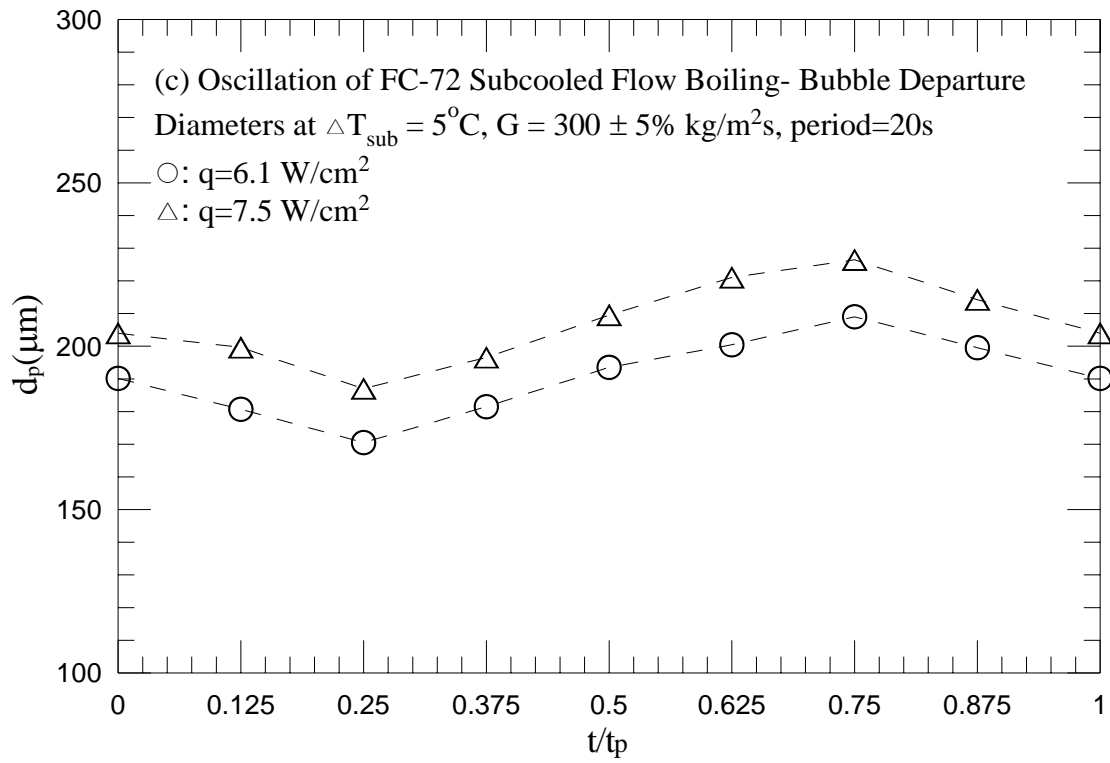
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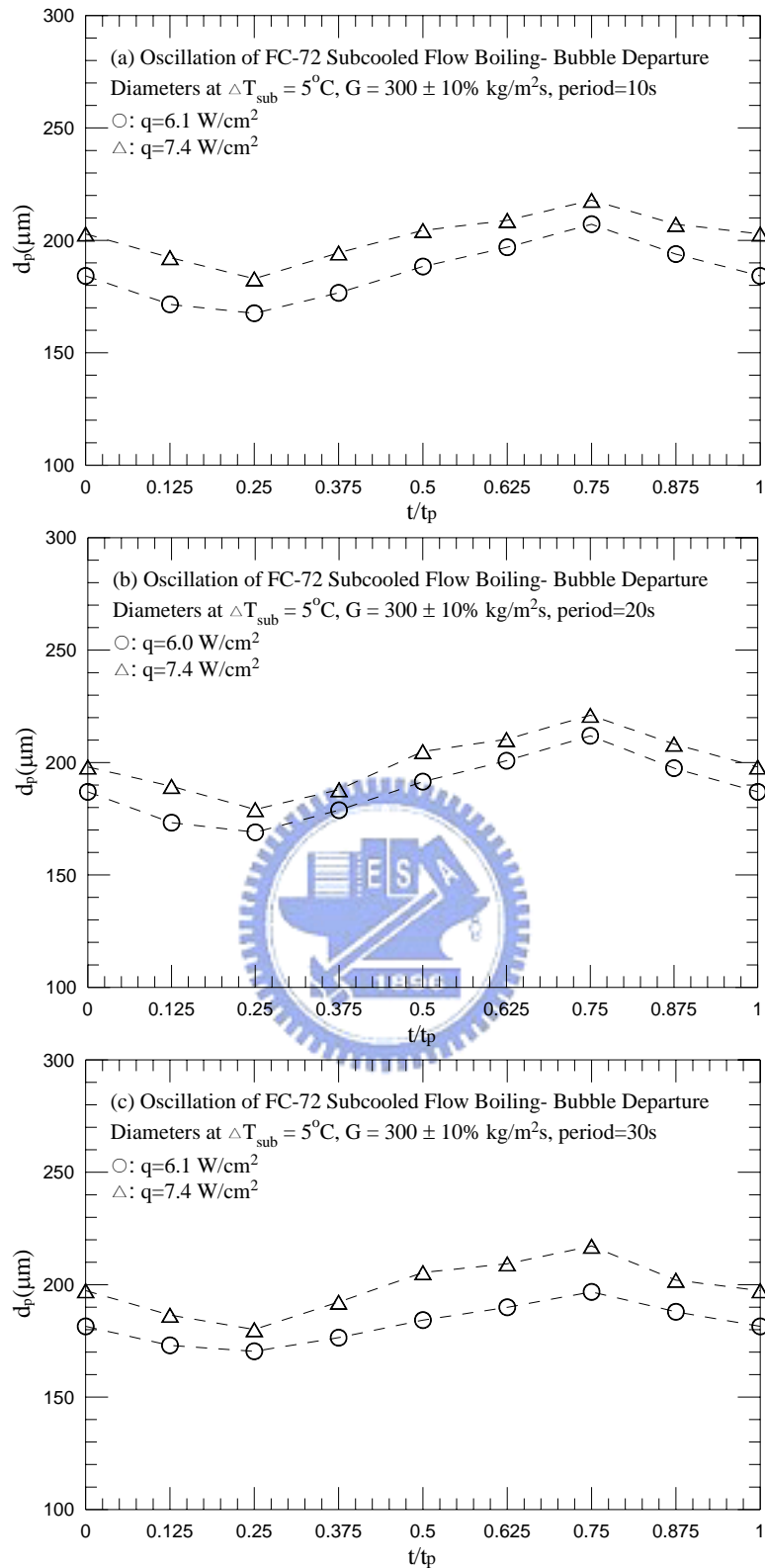
Fig. 5.148 Mean bubble departure diameters for various imposed heat fluxes for transient subcooled flow boiling for G=300±10% kg/m^{2}s and ΔT_{sub} =5°C with t$_p$=10 sec (a), 20sec (b) and 30 sec (c).
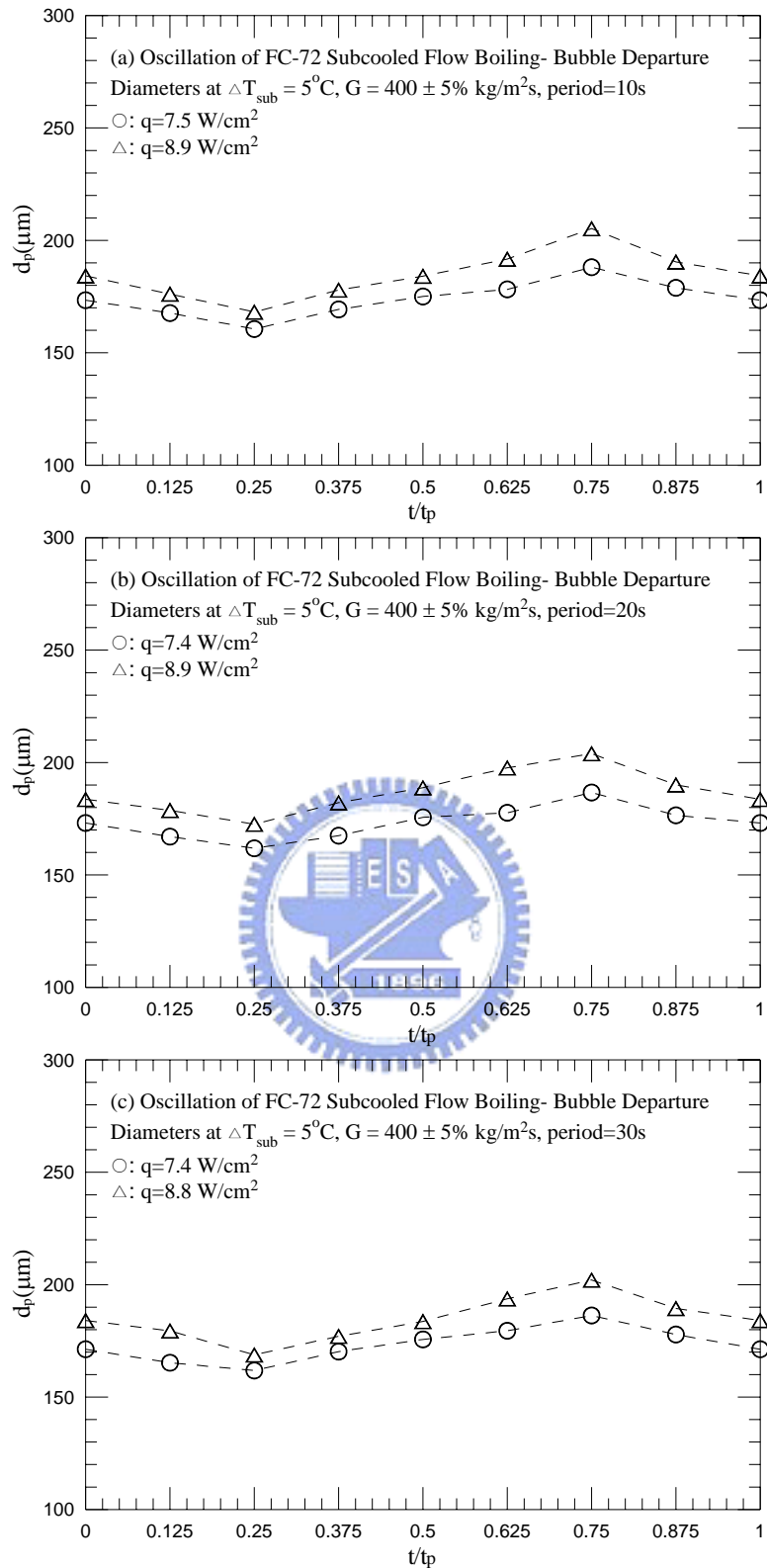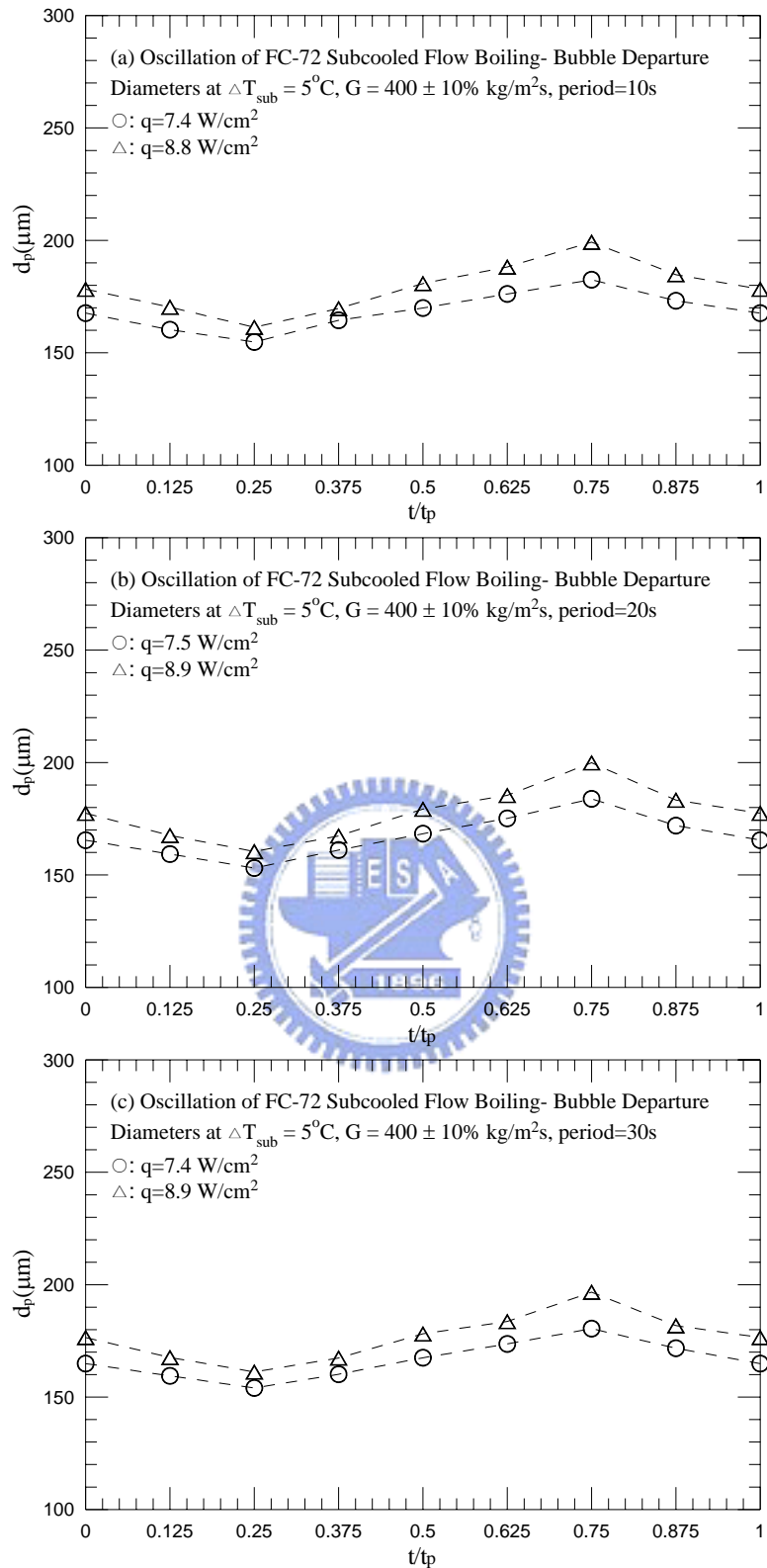
Fig. 5.149 Mean bubble departure diameters for various imposed heat fluxes for transient subcooled flow boiling for G=400±5% kg/m^{2}s and ΔT_{sub} =5°C with t$_p$=10 sec (a), 20sec (b) and 30 sec (c).

Fig. 5.150 Mean bubble departure diameters for various imposed heat fluxes for transient subcooled flow boiling for G=400±10% kg/m^{2}s and ΔT_{sub} =5°C with t$_p$=10 sec (a), 20sec (b) and 30 sec (c).
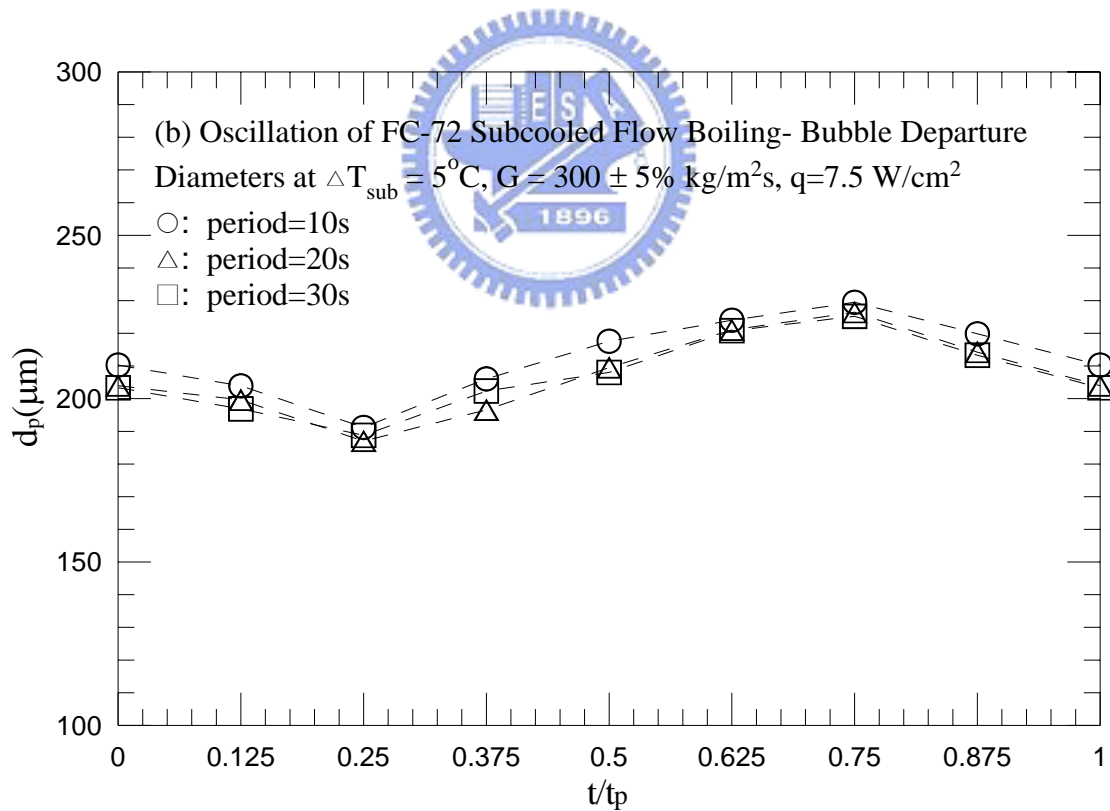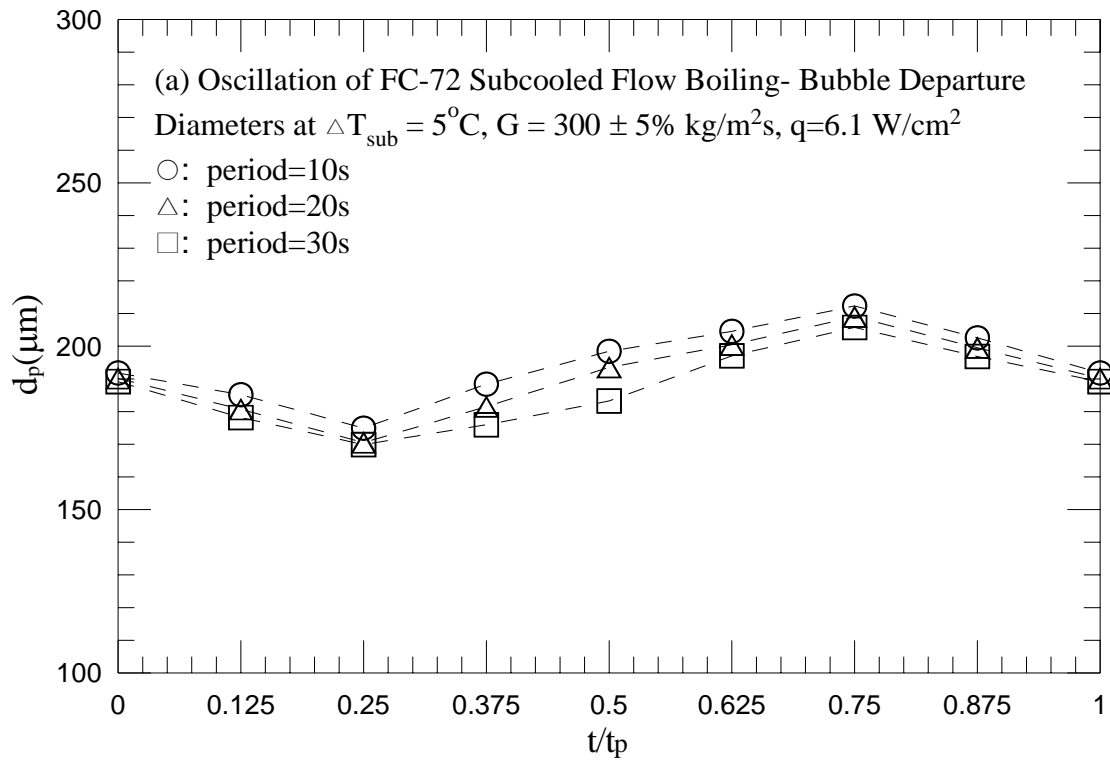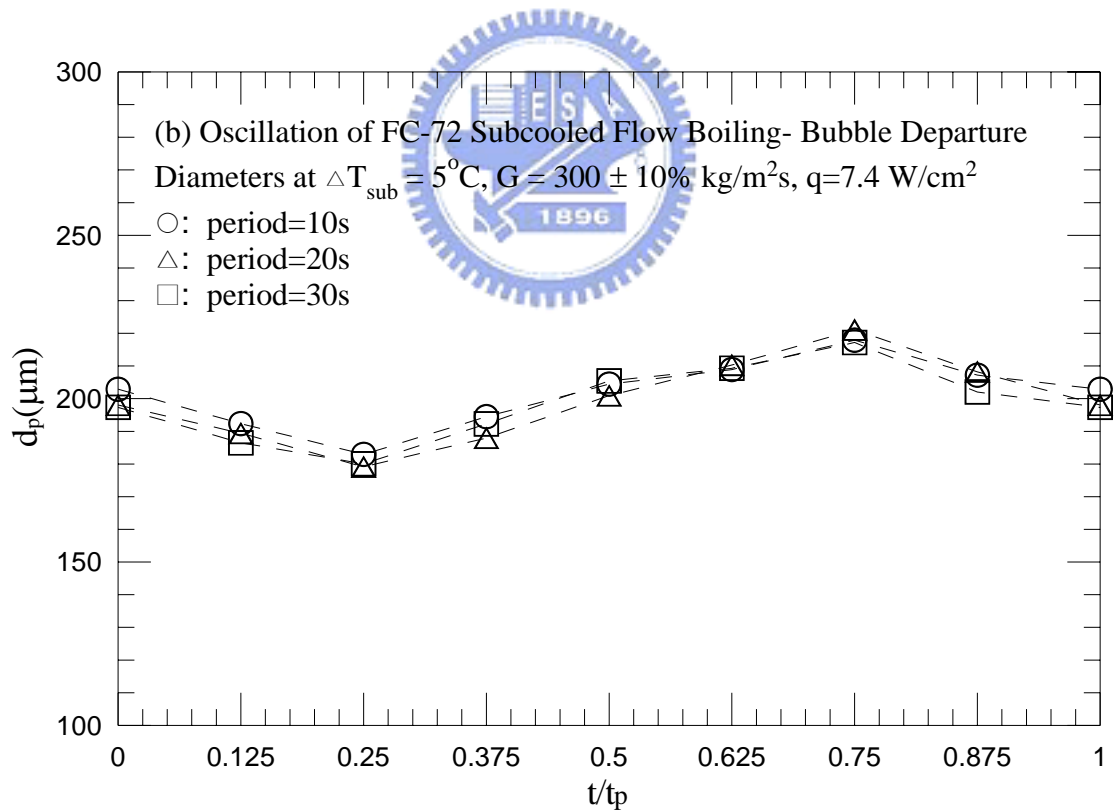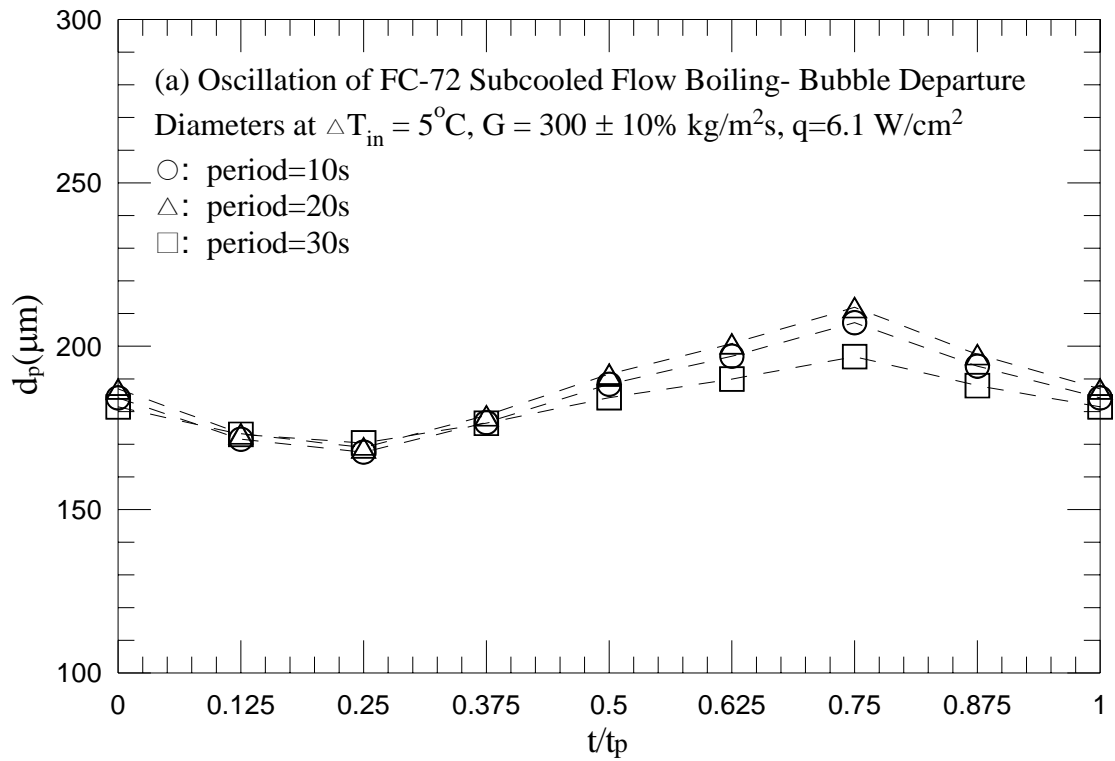
Fig. 5.151 Mean bubble departure diameters for various period of mass flux oscillation for transient subcooled flow boiling for G=300±5% kg/m^{2}s and $\triangle T_{sub}$ =5°C with (a) q=6.1 W/cm^2 and (b) q=7.5 W/cm^2.
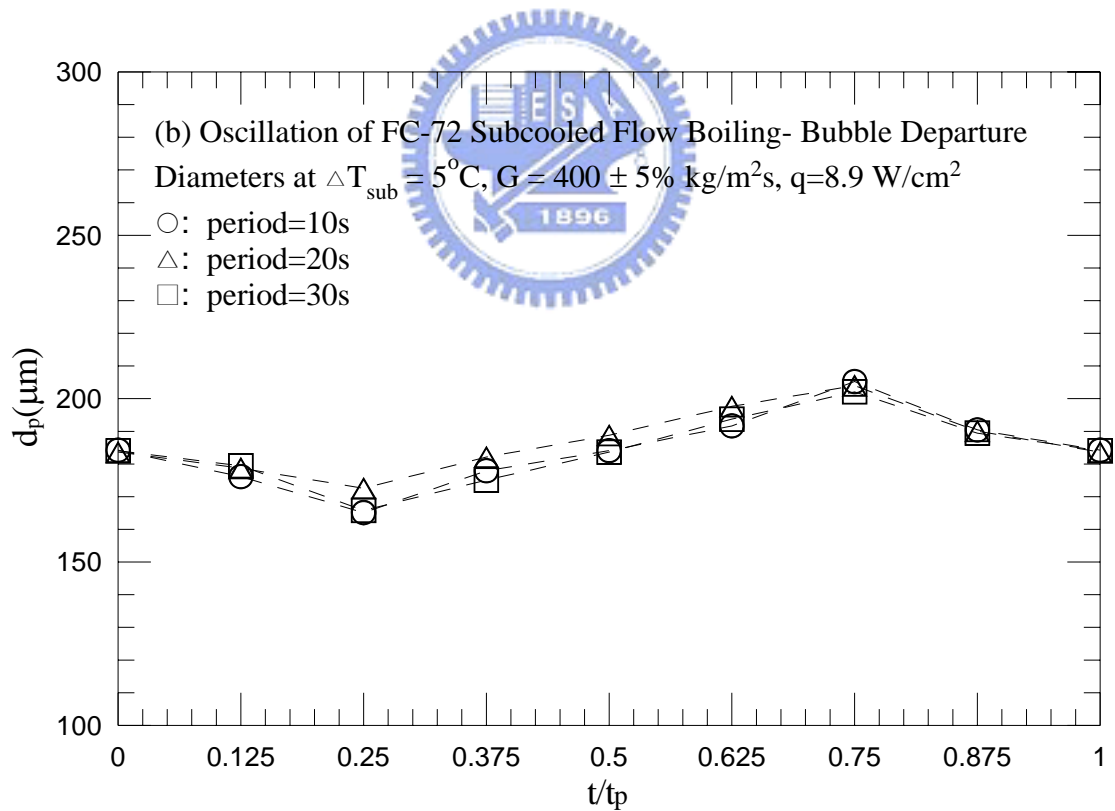
Fig. 5.152 Mean bubble departure diameters for various period of mass flux oscillation for transient subcooled flow boiling for $G=300\pm10\%$ kg/m^{2}s and ΔT_{sub} =5°C with (a) q=6.1 W/cm^2 and (b) q=7.4 W/cm^2.

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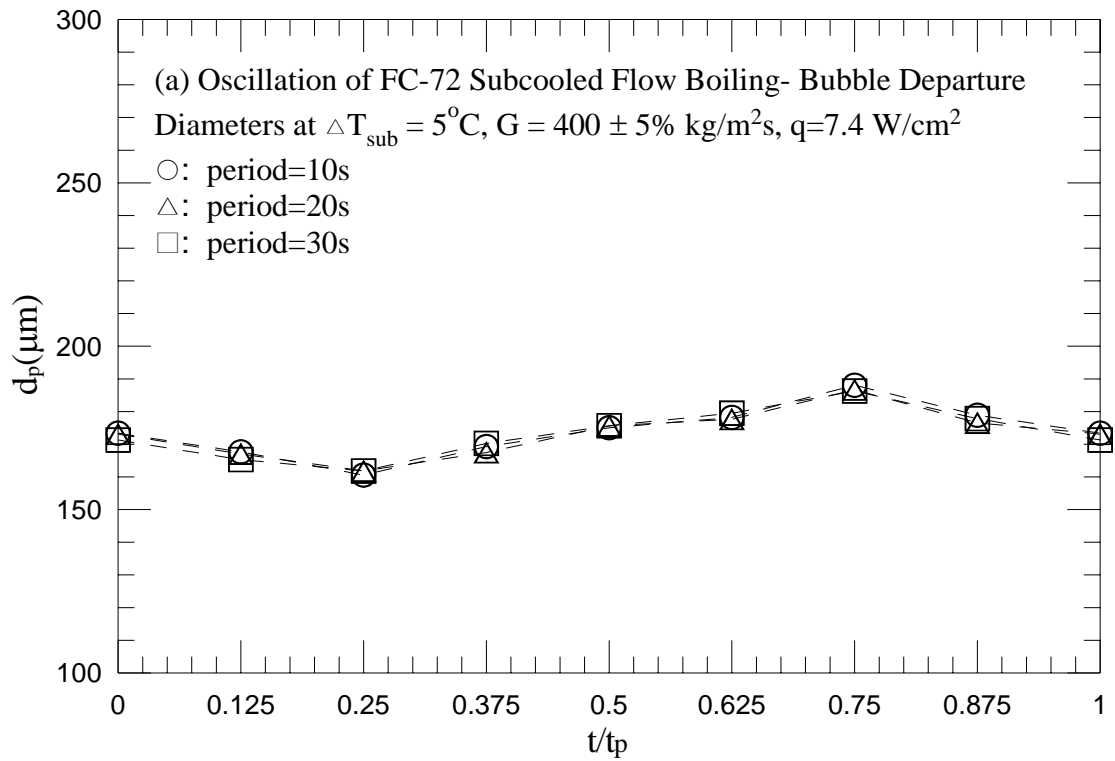
Fig. 5.153 Mean bubble departure diameters for various period of mass flux oscillation for transient subcooled flow boiling for G=400±5% kg/m²s and $\triangle T_{sub}$ =5°C with (a) q=7.4 W/cm² and (b) q=8.9 W/cm².
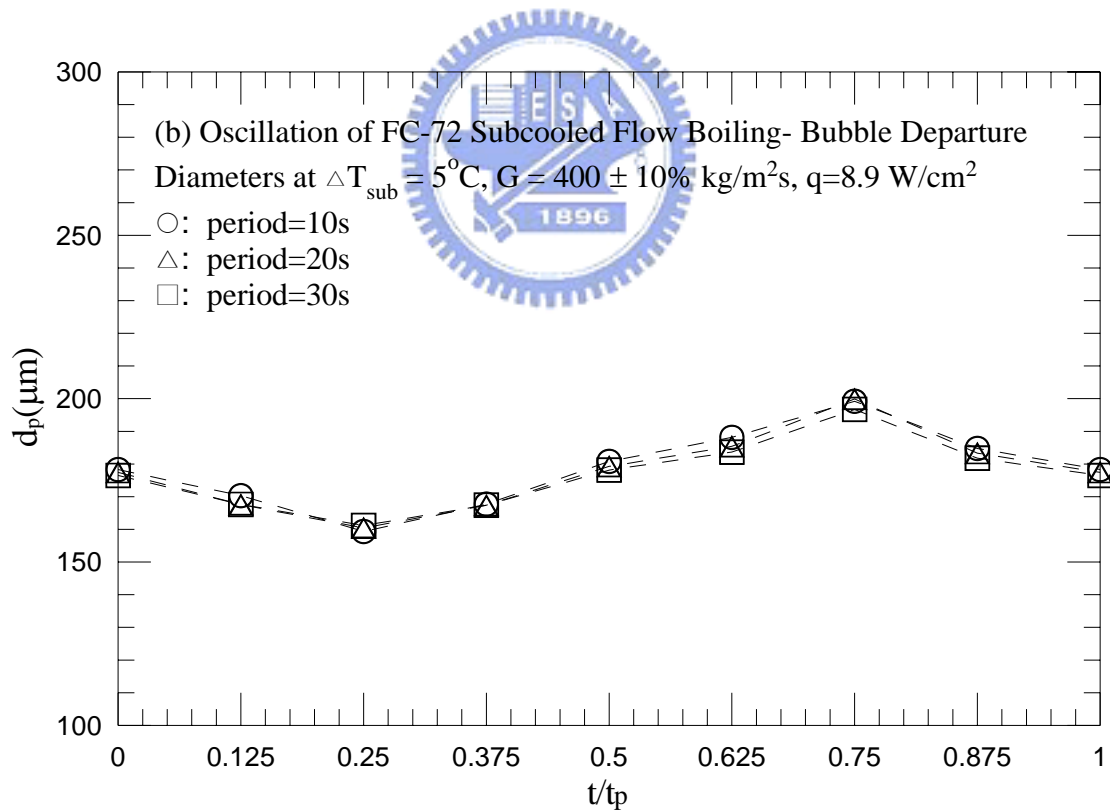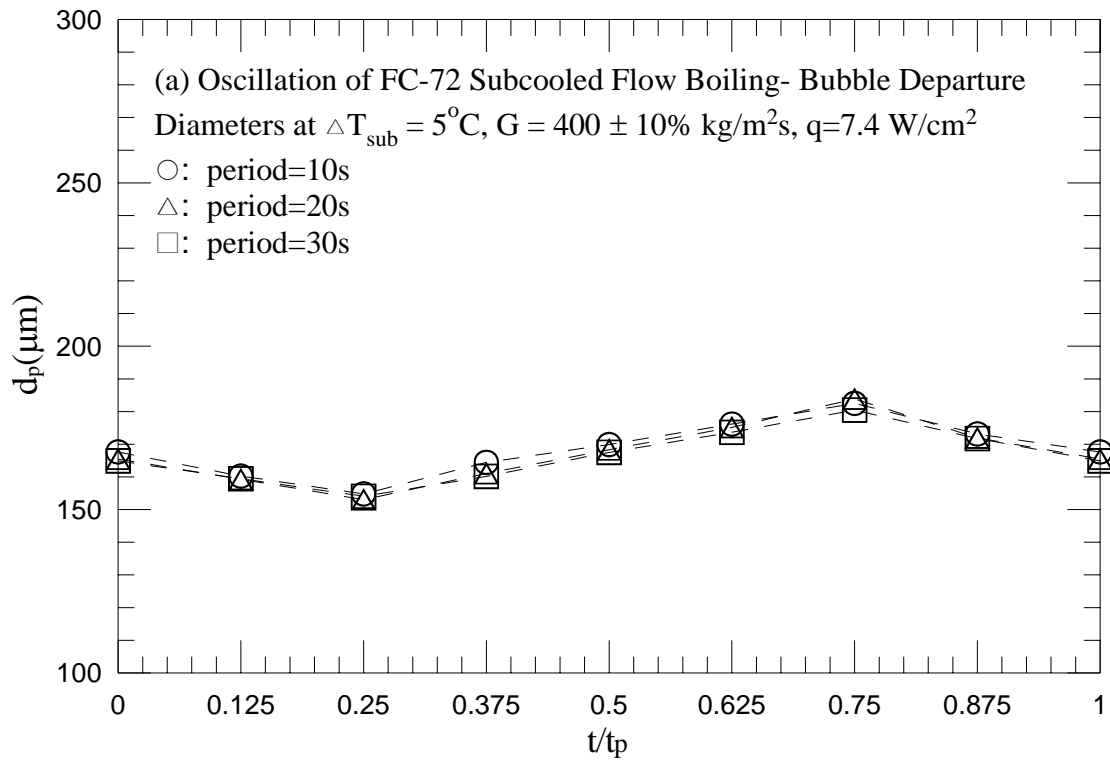
Fig. 5.154 Mean bubble departure diameters for various period of mass flux oscillation for transient subcooled flow boiling for G=400±10% kg/m^{2}s and ΔT_{sub} =5°C with (a) q=7.4 W/cm^2 and (b) q=8.9 W/cm^2.
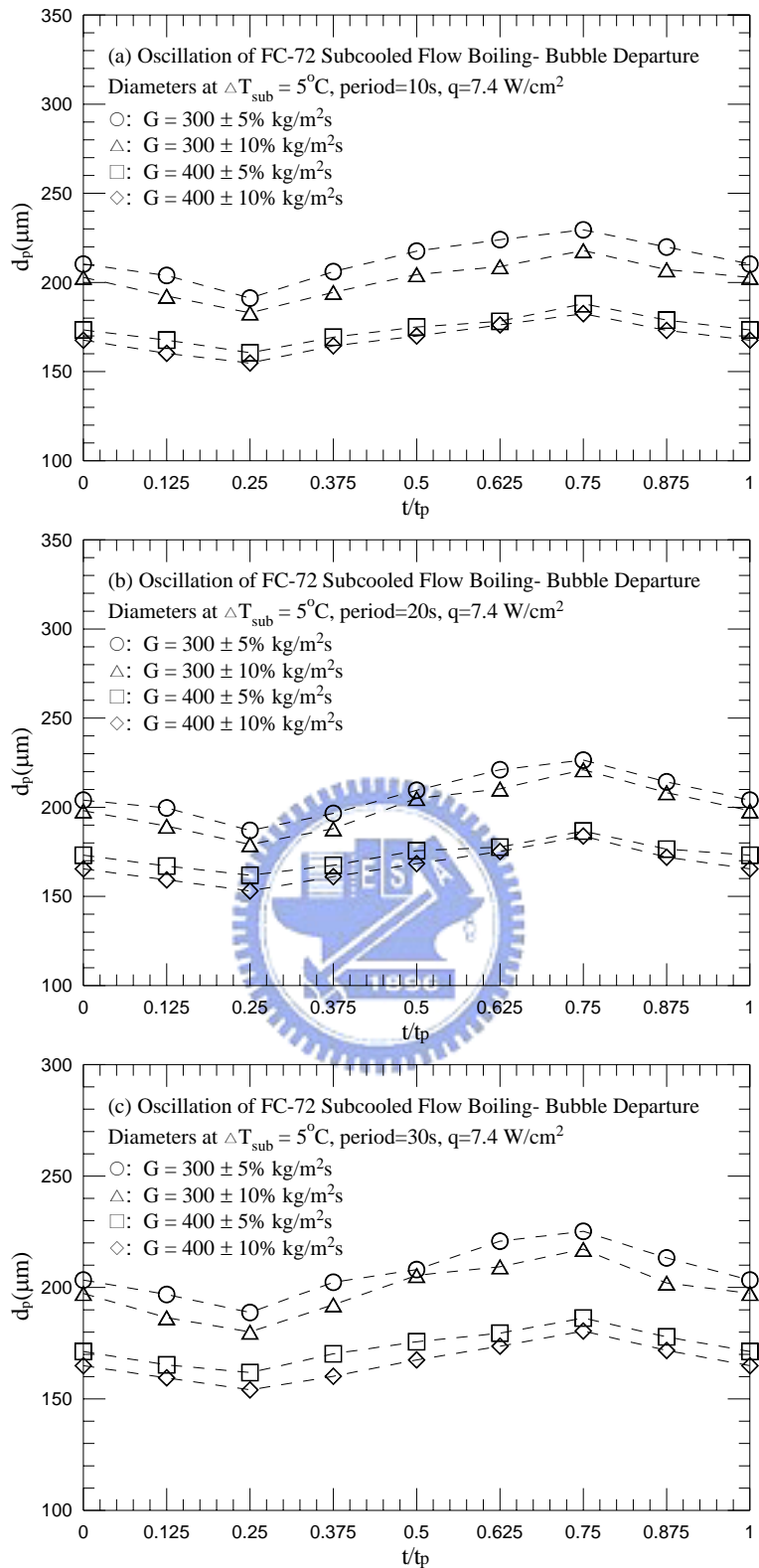
Fig. 5.155 Mean bubble departure diameters for various amplitudes of the mass fluxes oscillation for transient subcooled flow boiling for q=7.4 W/cm^2 and ΔT_{sub} =5°C with period=10 sec (a), 20 sec (b), and 30 sec (c).
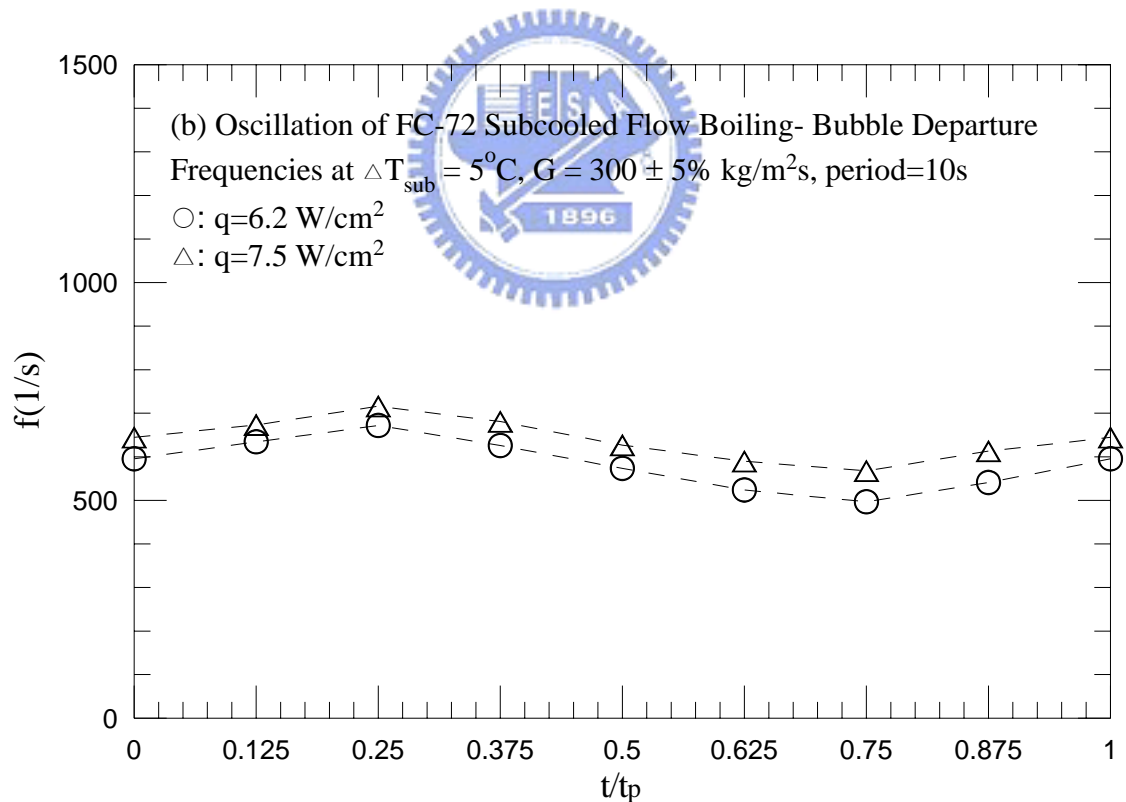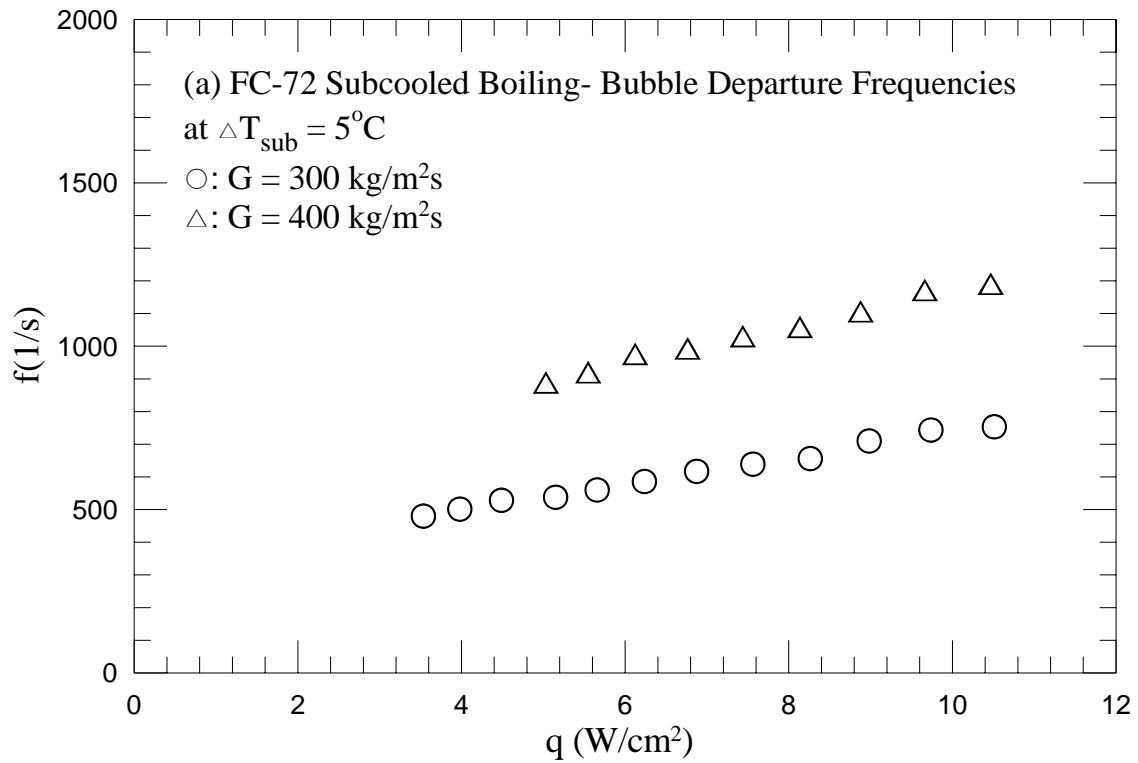
Fig. 5.156 Mean bubble departure frequencies for various coolant mass fluxes for stable subcooled flow boiling (a) and various imposed heat fluxes for transient subcooled flow boiling for G=300±5% kg/m^{2}s and ΔT_{sub} =5°C with t_p=10 sec (b), 20sec (c) and 30 sec (d).

(c) Oscillation of FC-72 Subcooled Flow Boiling- Bubble Departure Frequencies at $\triangle T_{sub} = 5^{o}$C, G = 300 ± 5% kg/m²s, period=20s

○: q=6.1 W/cm²
△: q=7.5 W/cm²

(d) Oscillation of FC-72 Subcooled Flow Boiling- Bubble Departure Frequencies at $\triangle T_{sub} = 5^{o}$C, G = 300 ± 5% kg/m²s, period=30s
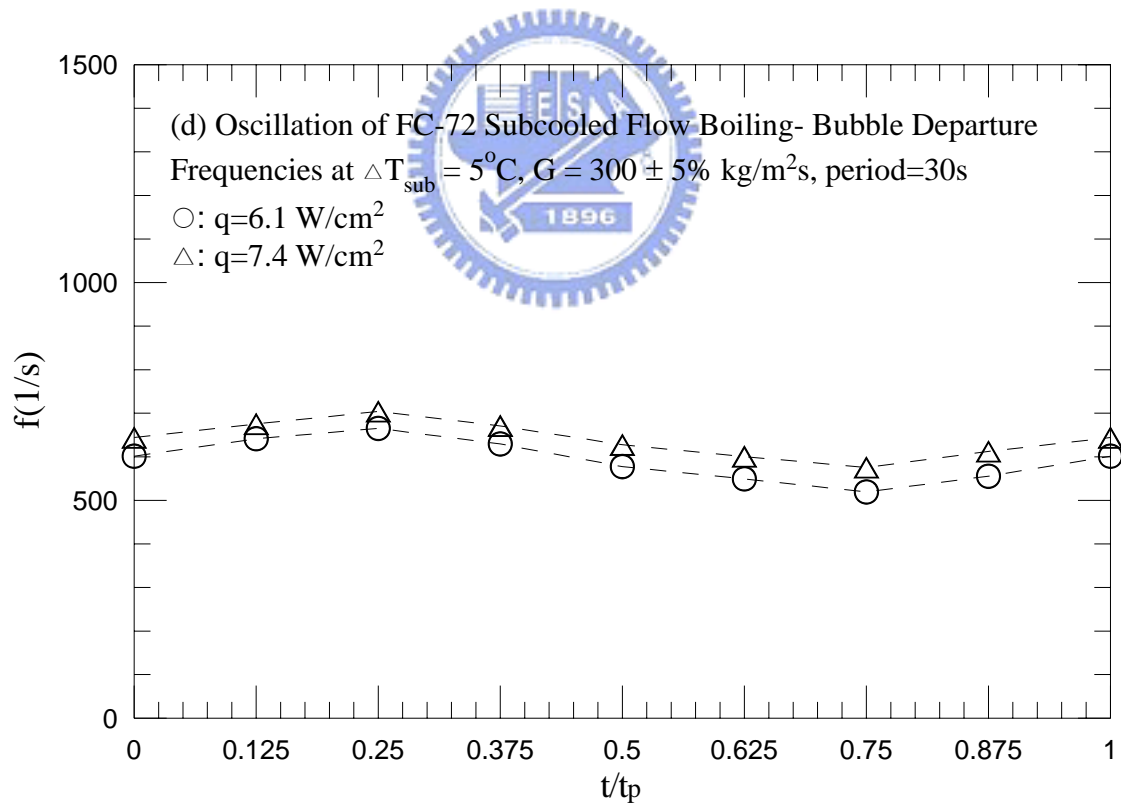
○: q=6.1 W/cm²
△: q=7.4 W/cm²
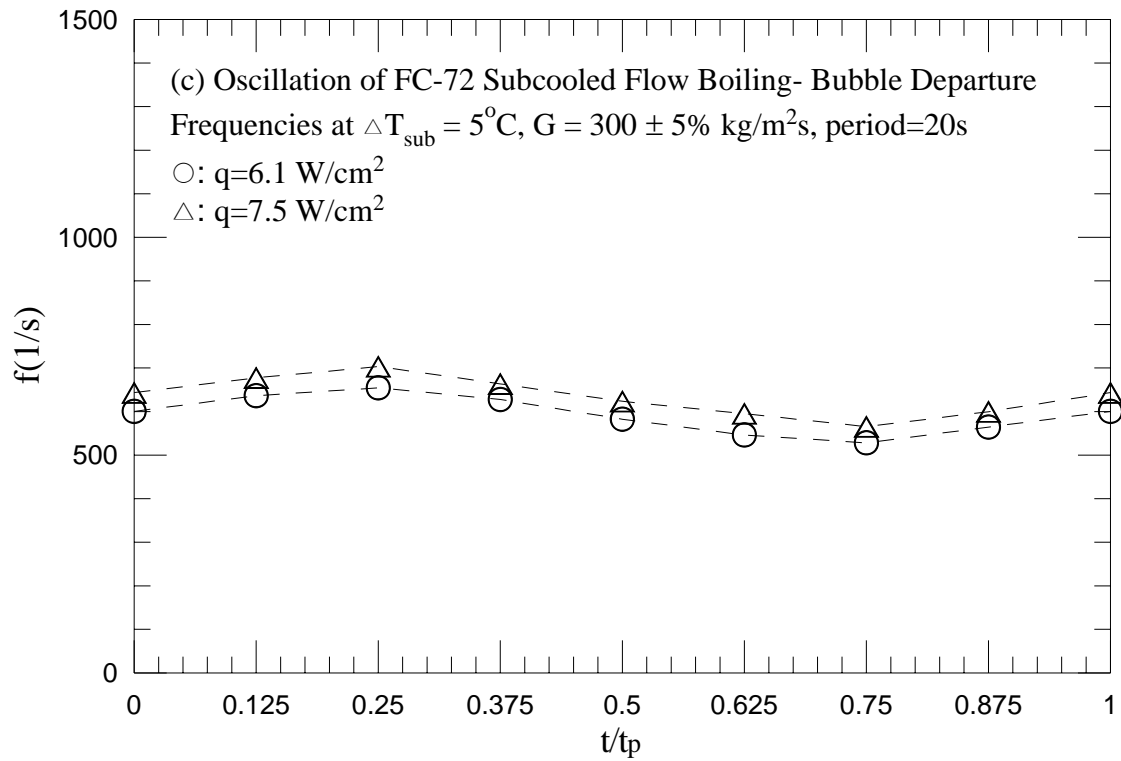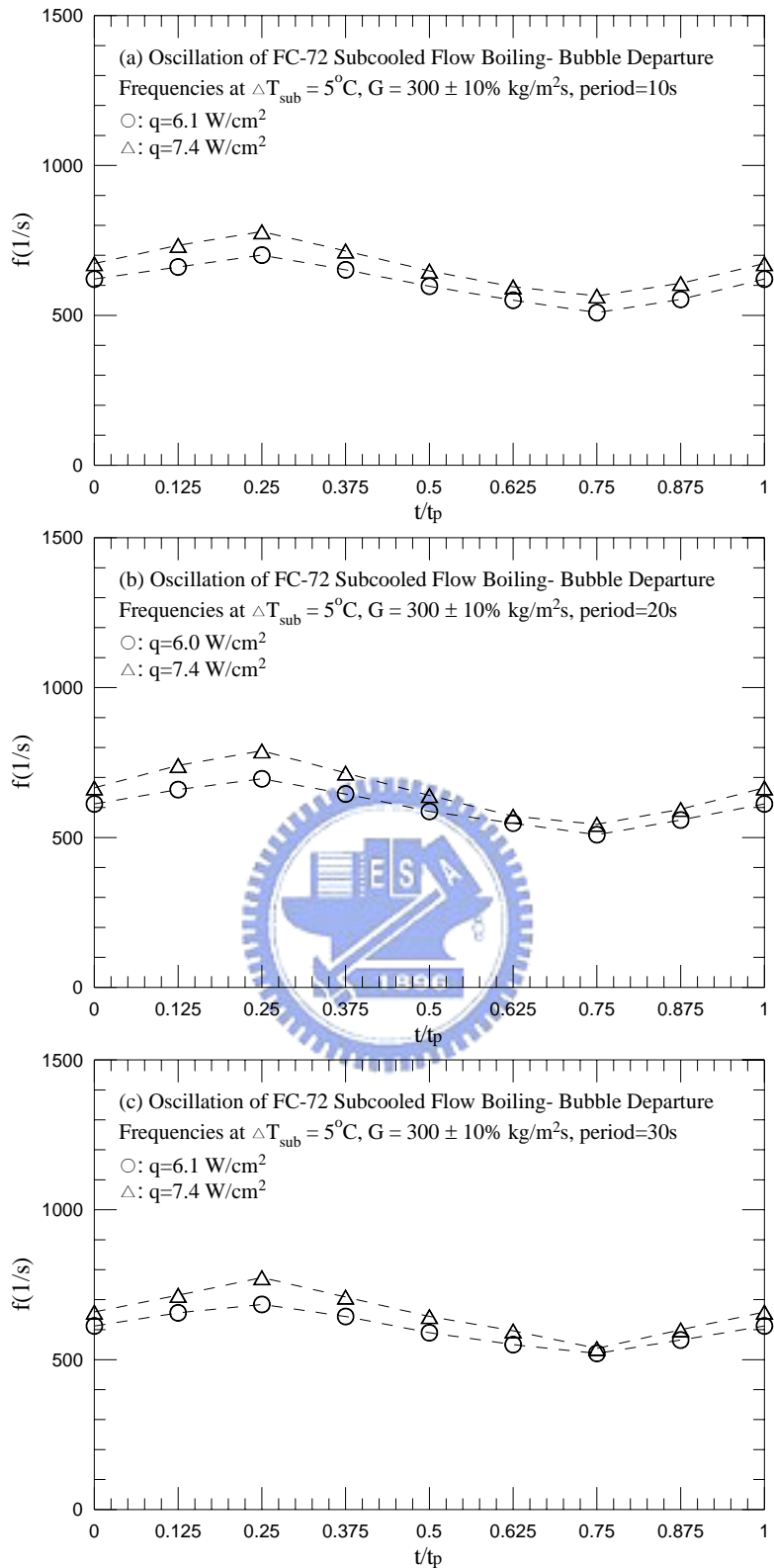
Fig. 5.156 Continued.

Fig. 5.157 Mean bubble departure frequencies for various imposed heat fluxes for transient subcooled flow boiling for G=300±10% kg/m^{2}s and ΔT_{sub} =5°C with t$_p$=10 sec (a), 20sec (b) and 30 sec (c).
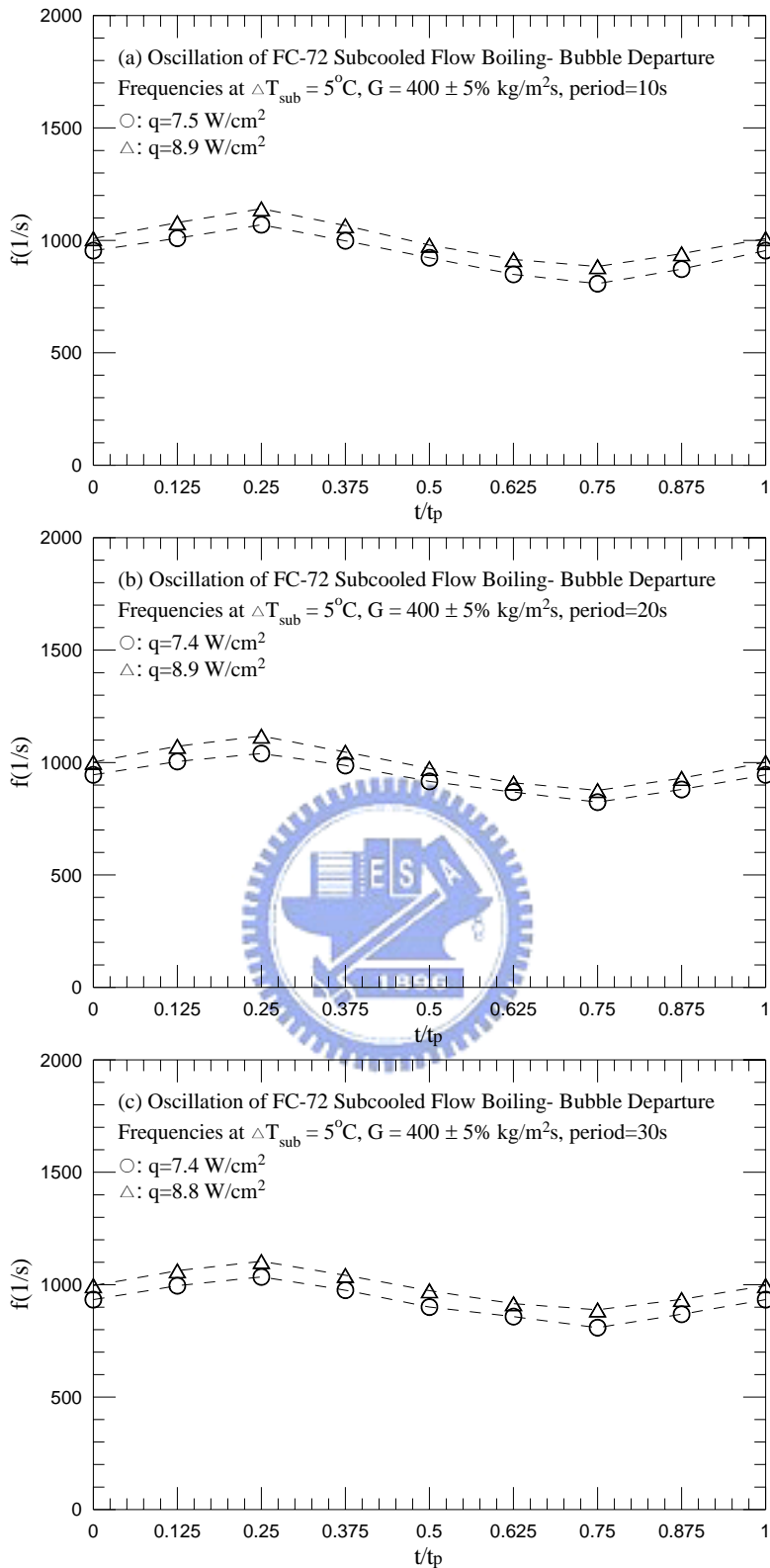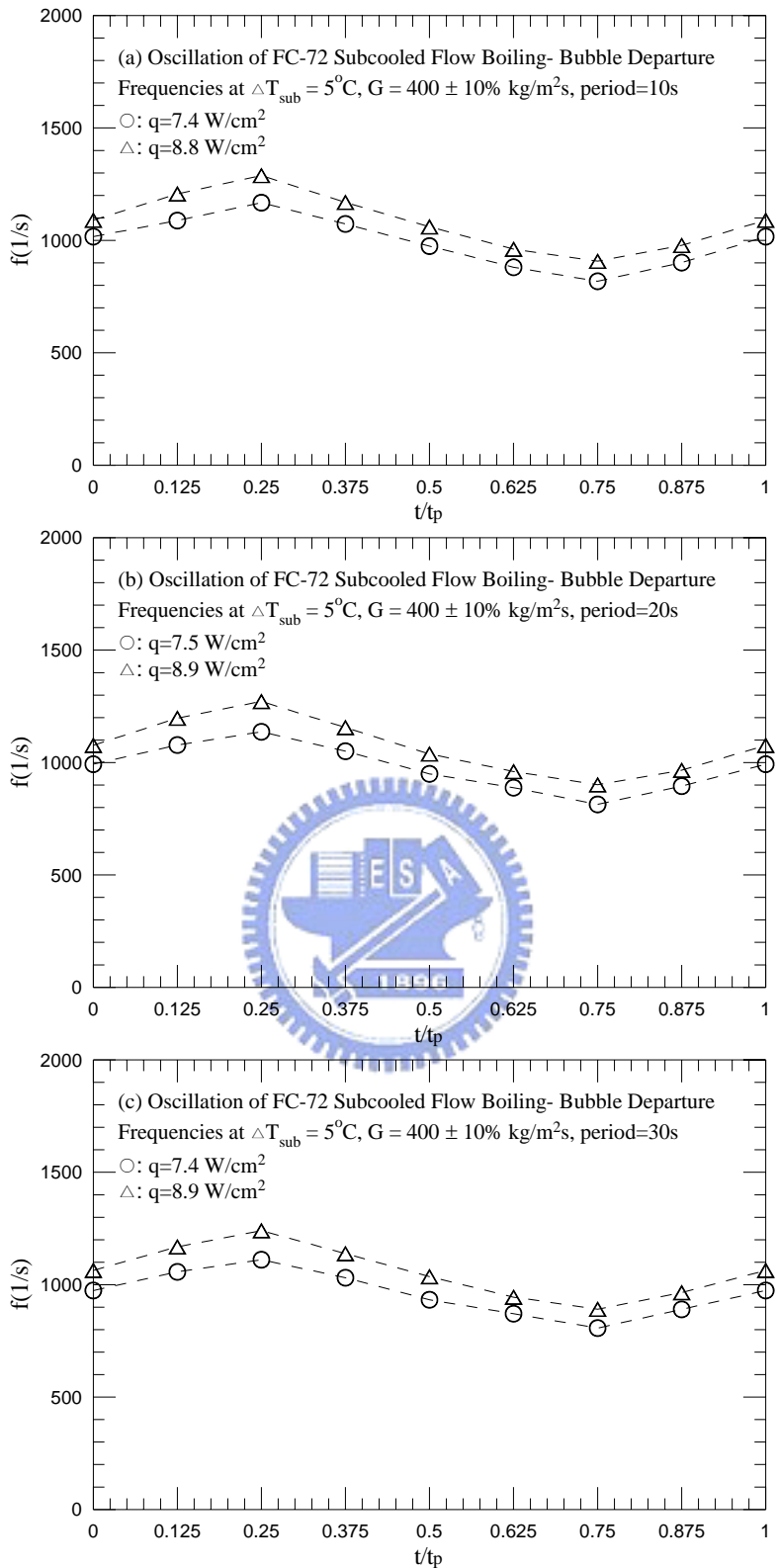
Fig. 5.158 Mean bubble departure frequencies for various imposed heat fluxes for transient subcooled flow boiling for G=400±5% kg/m^{2}s and ΔT_{sub} =5°C with t$_p$=10 sec (a), 20sec (b) and 30 sec (c).

Fig. 5.159 Mean bubble departure frequencies for various imposed heat fluxes for transient subcooled flow boiling for G=400±10% kg/m^{2}s and ΔT_{sub} =5°C with t$_p$=10 sec (a), 20sec (b) and 30 sec (c).
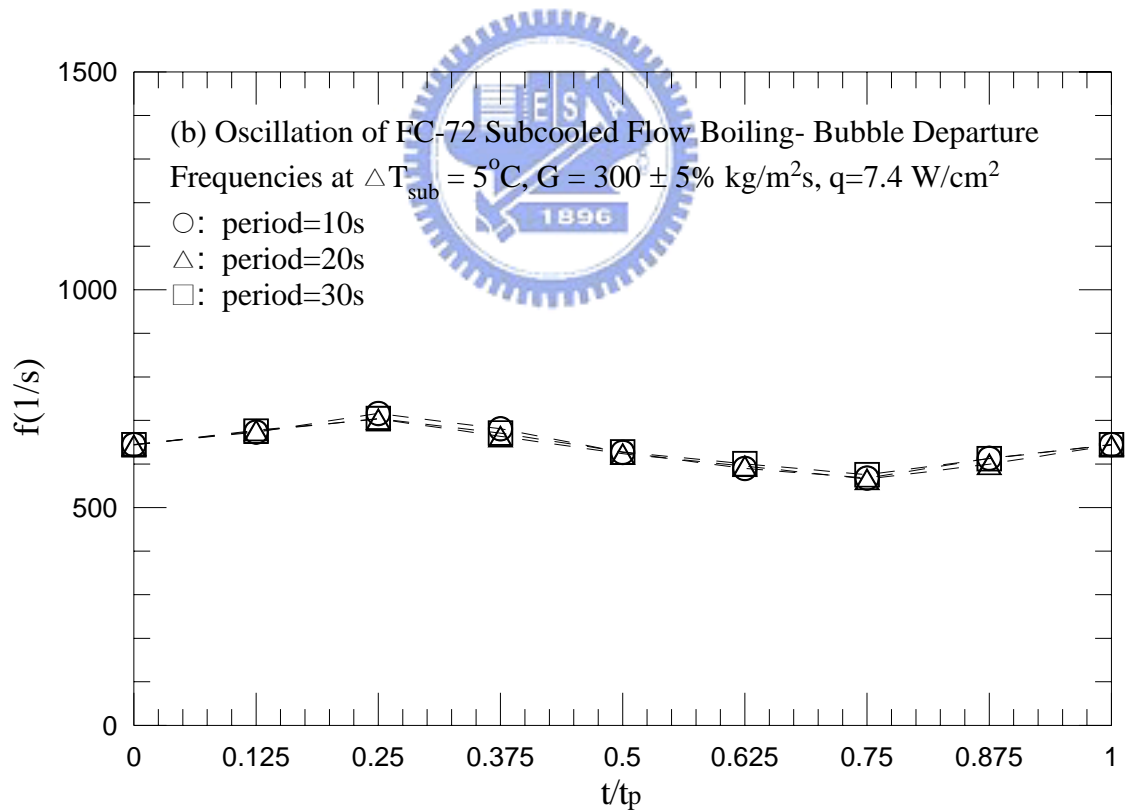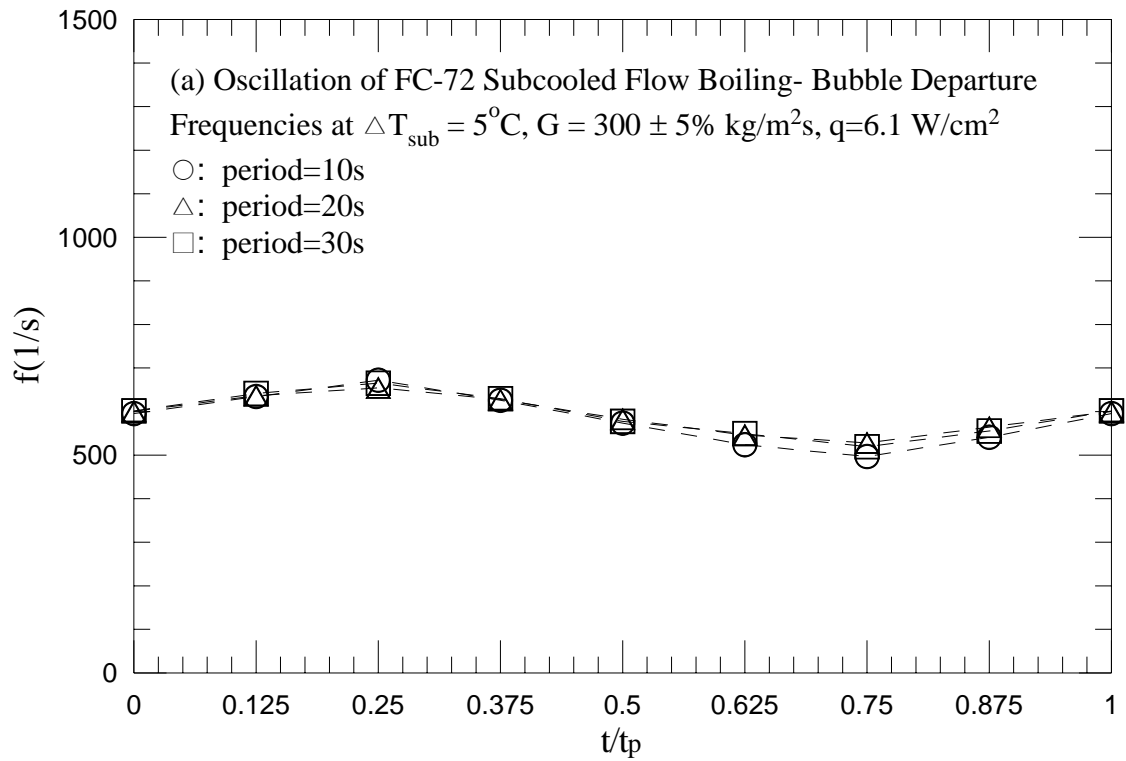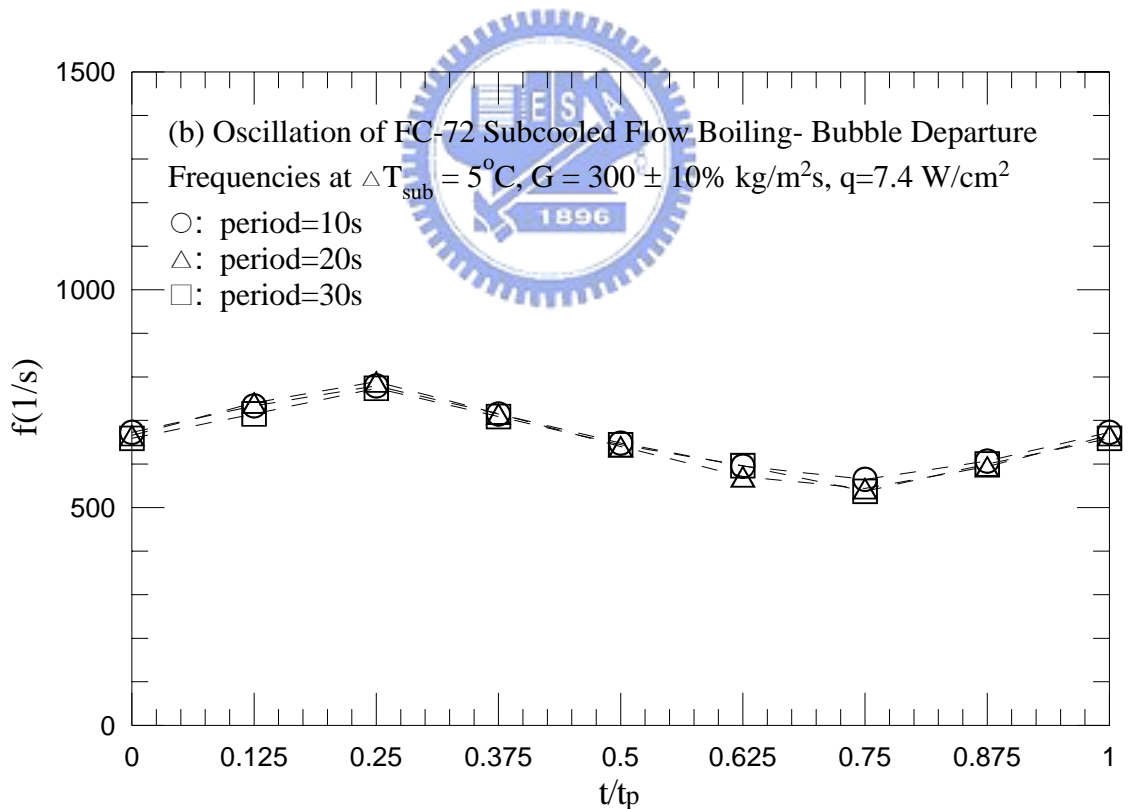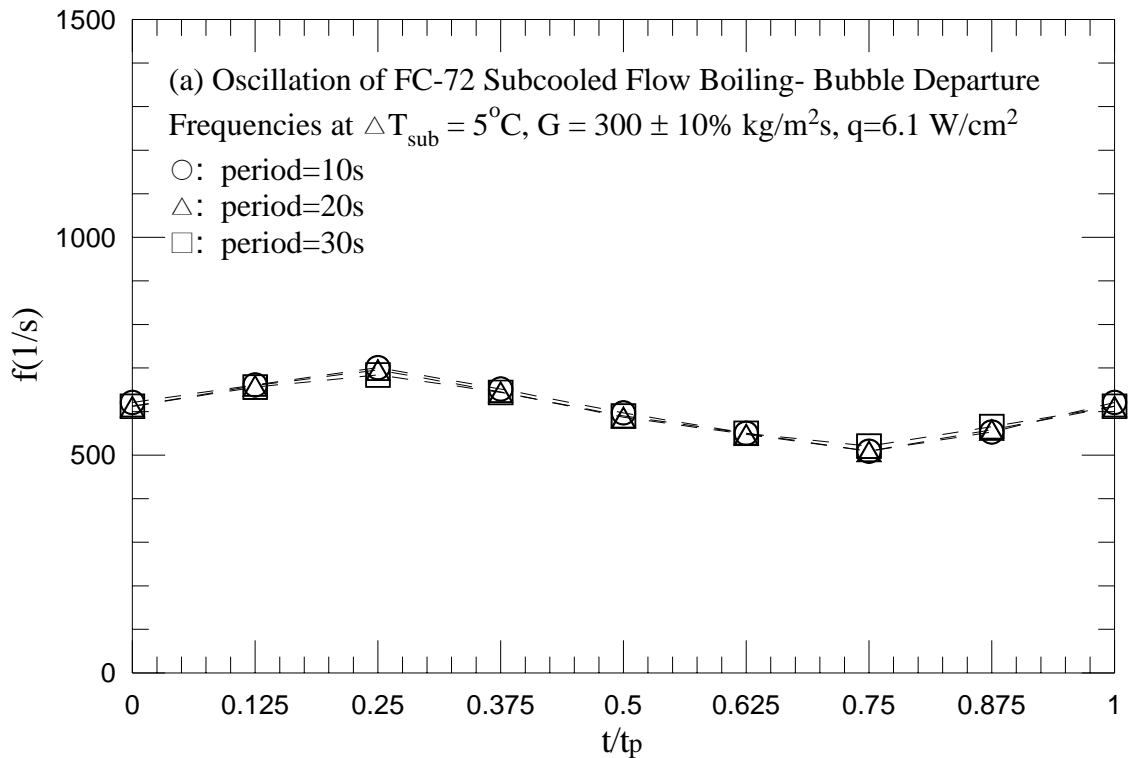
Fig. 5.160 Mean bubble departure frequencies for various periods of mass flux oscillation for transient subcooled flow boiling for G=300±5% kg/m²s and $\triangle T_{sub}$ =5°C with (a) q=6.1 W/cm² and (b) q=7.4 W/cm².
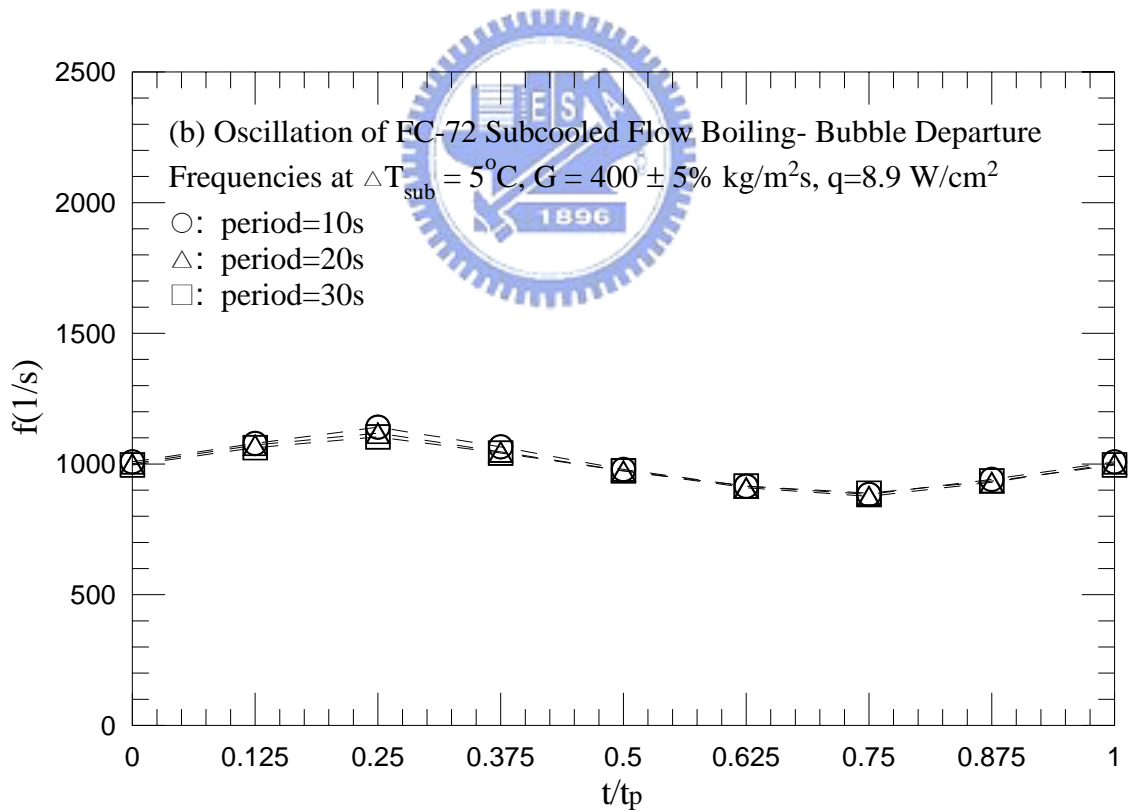
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Fig. 5.161 Mean bubble departure frequencies for various periods of mass flux oscillation for transient subcooled flow boiling for G=300±10% kg/m^{2}s and ΔT_{sub} =5°C with (a) q=6.1 W/cm^2 and (b) q=7.4 W/cm^2.
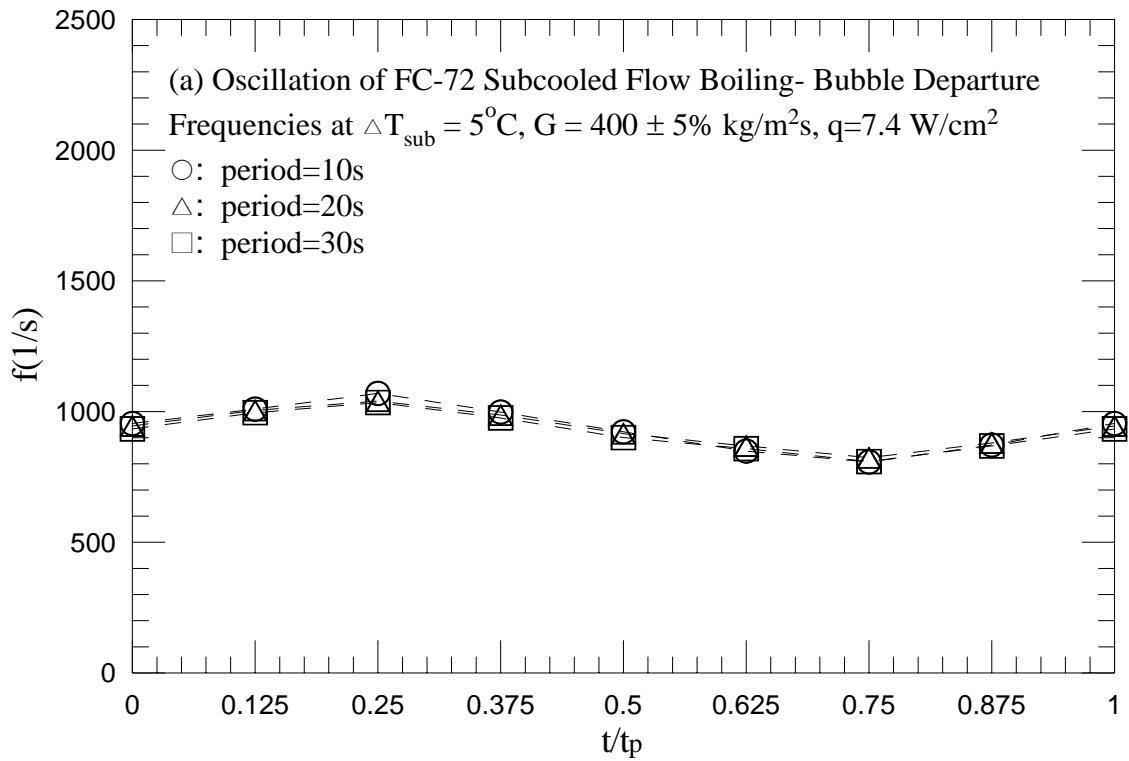
Fig. 5.162 Mean bubble departure frequencies for various periods of mass flux oscillation for transient subcooled flow boiling for G=400±5% kg/m^{2}s and $\triangle T_{sub}$ =5°C with (a) q=7.4 W/cm^2 and (b) q=8.9 W/cm^2.
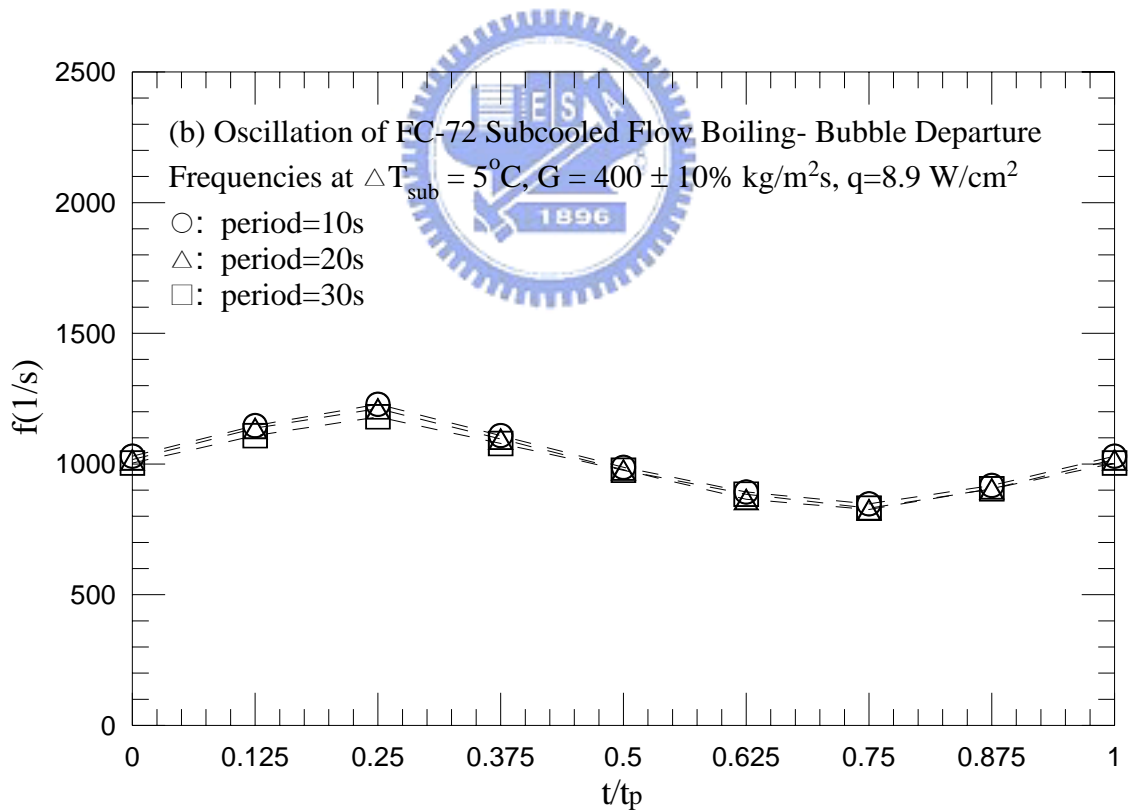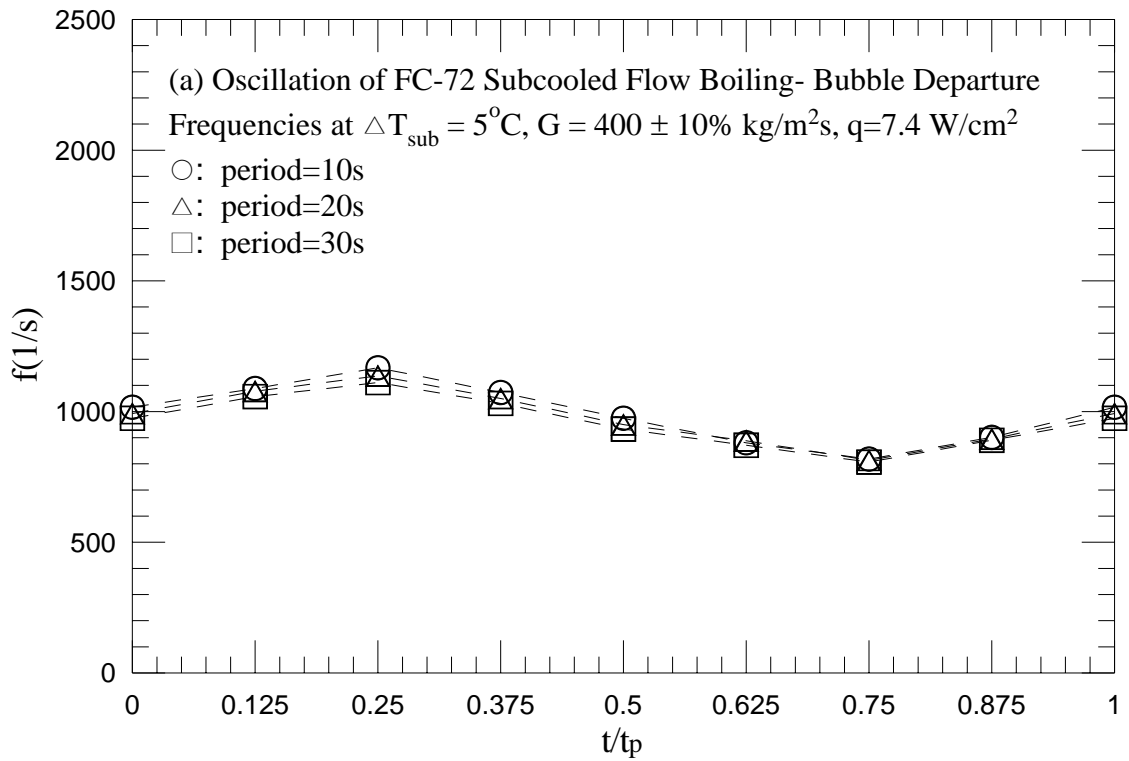
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Fig. 5.163 Mean bubble departure frequencies for various periods of mass flux oscillation for transient subcooled flow boiling for G=400±10% kg/m^{2}s and ΔT_{sub} =5°C with (a) q=7.4 W/cm^2 and (b) q=8.9 W/cm^2.
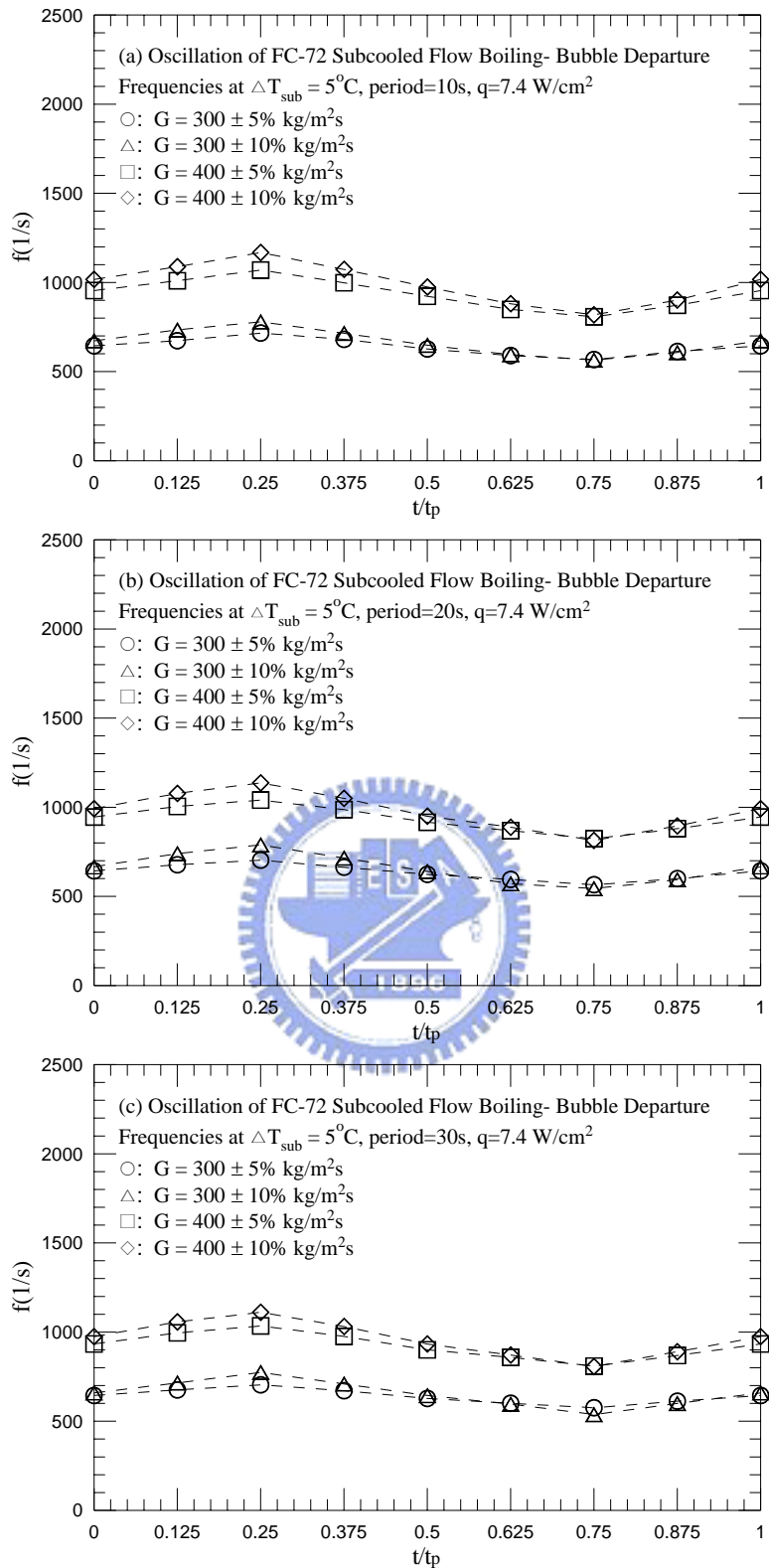
338

Fig. 5.164 Mean bubble departure frequencies for various amplitudes of the mass fluxes oscillation for transient subcooled flow boiling for q=7.4 W/cm^2 and ΔT_{sub} =5°C with period=10 sec (a), 20 sec (b), and 30 sec (c).
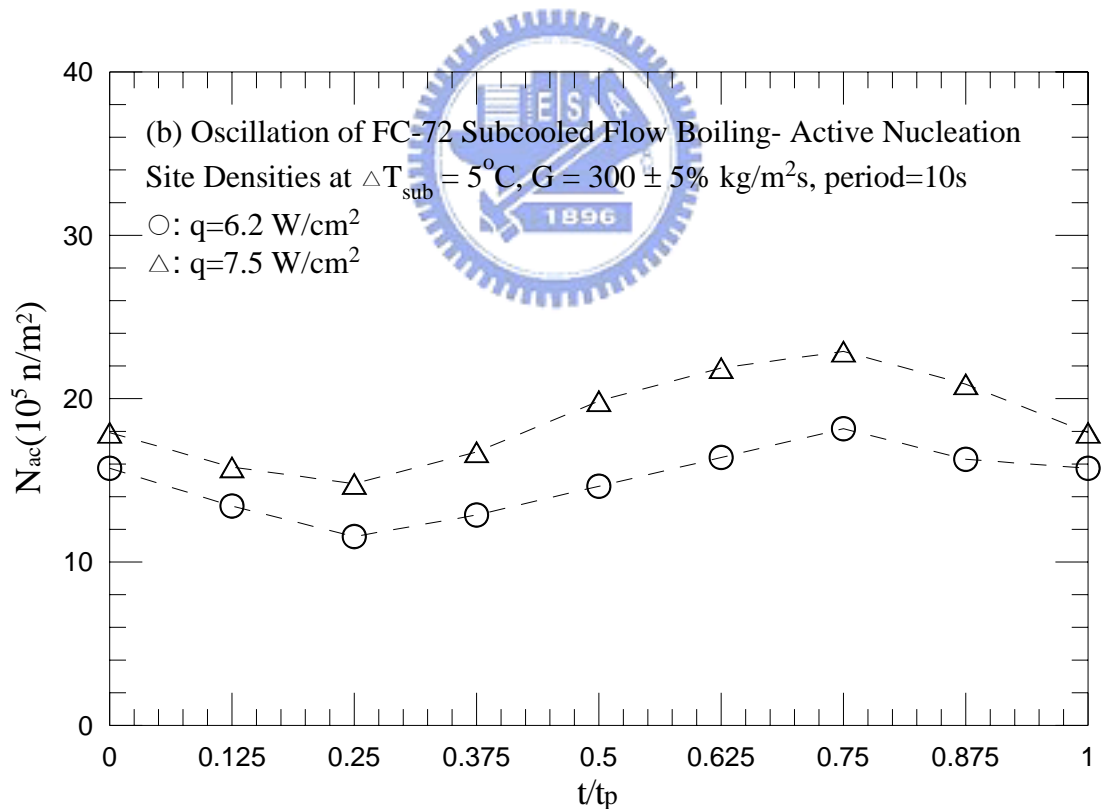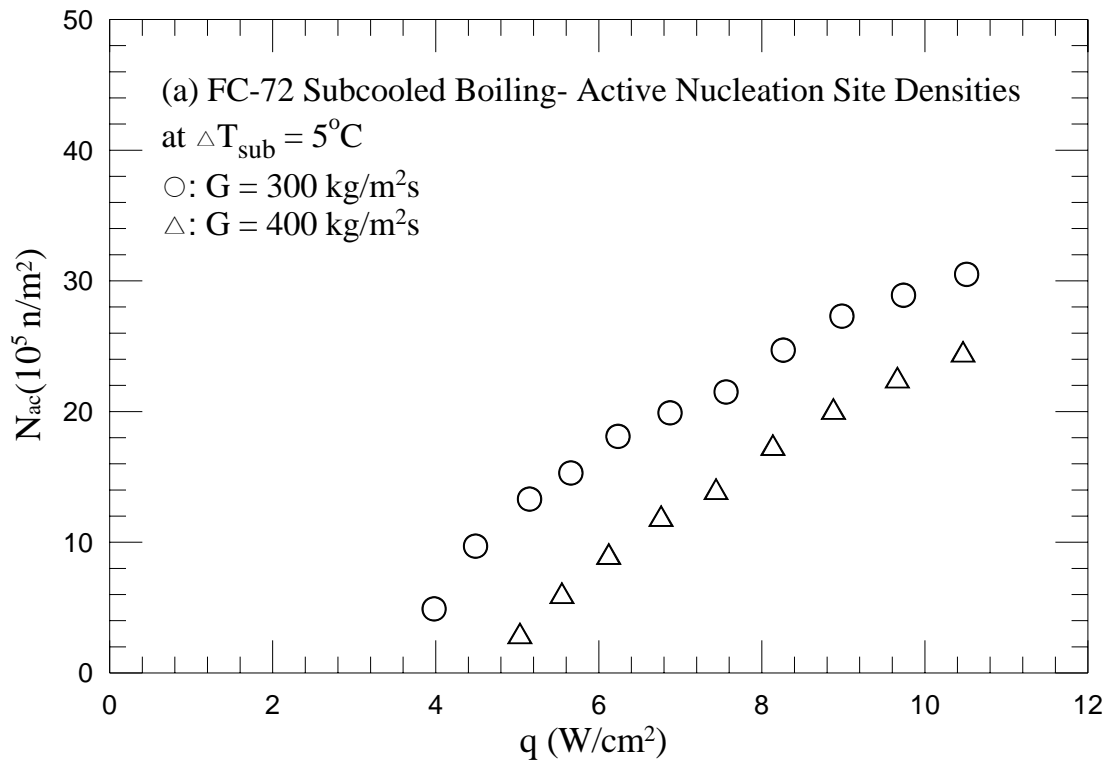
Fig. 5.165 Mean active nucleation site densities for various coolant mass fluxes for stable subcooled flow boiling (a) and various imposed heat fluxes for transient subcooled flow boiling for G=300±5% kg/m^{2}s and ΔT_{sub} =5°C with t$_p$=10 sec (b), 20sec (c) and 30 sec (d).

(c) Oscillation of FC-72 Subcooled Flow Boiling- Active Nucleation Site Densities at $\triangle T_{sub} = 5^o$C, G = 300 $\pm$ 5% kg/m^{2}s, period=20s
○: q=6.1 W/cm^2
△: q=7.5 W/cm^2

(d) Oscillation of FC-72 Subcooled Flow Boiling- Active Nucleation Site Densities at $\triangle T_{sub} = 5^o$C, G = 300 $\pm$ 5% kg/m^{2}s, period=30s
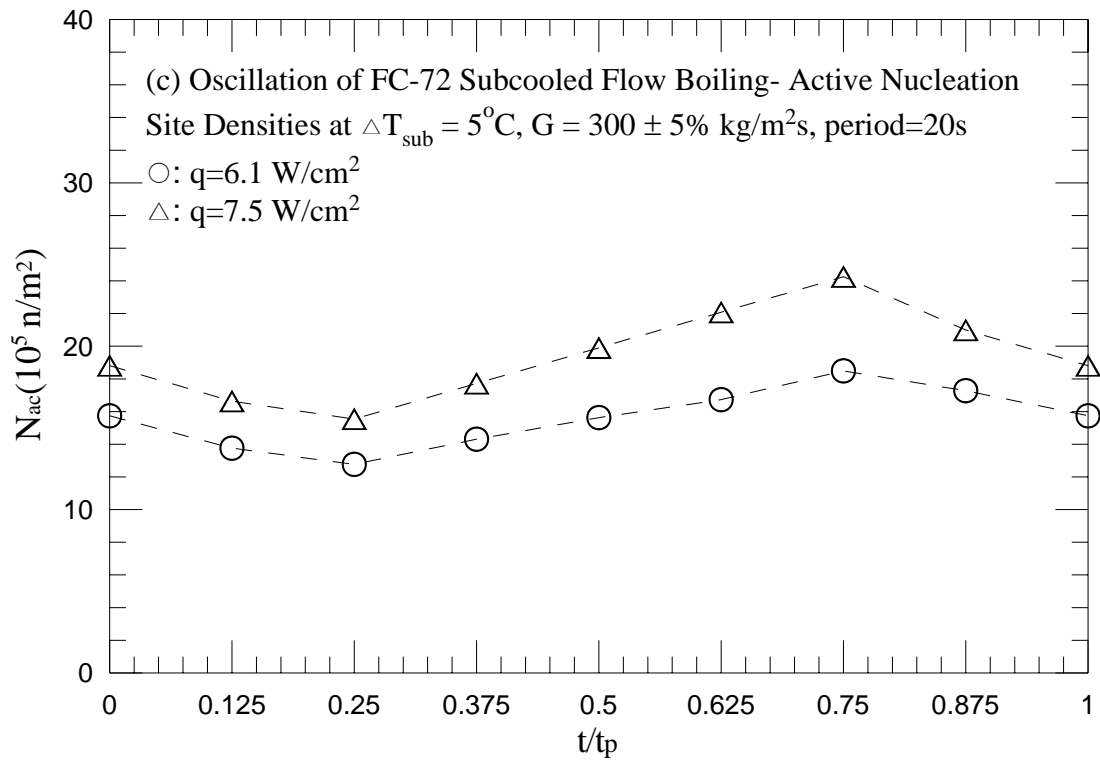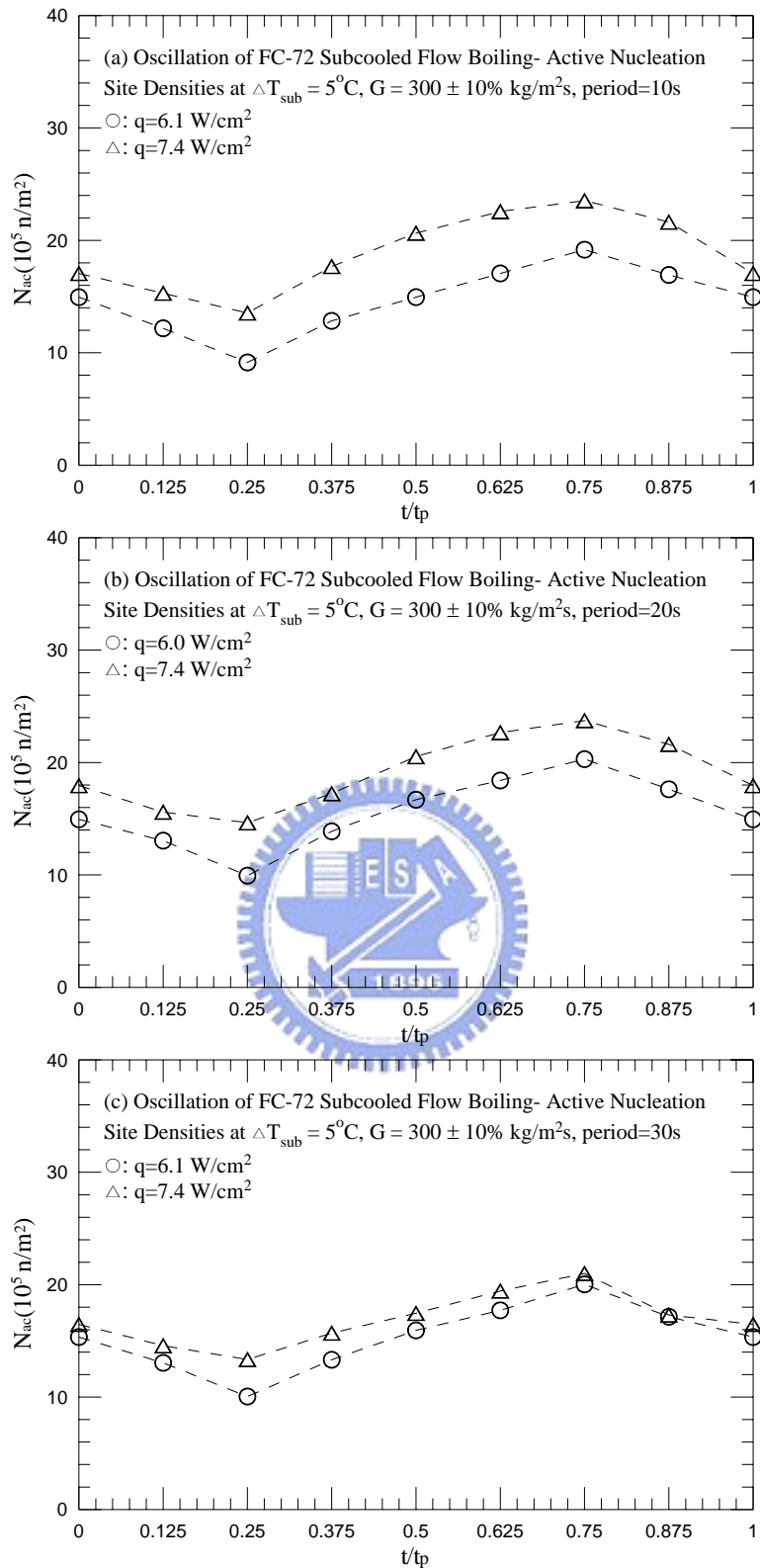○: q=6.1 W/cm^2
△: q=7.4 W/cm^2
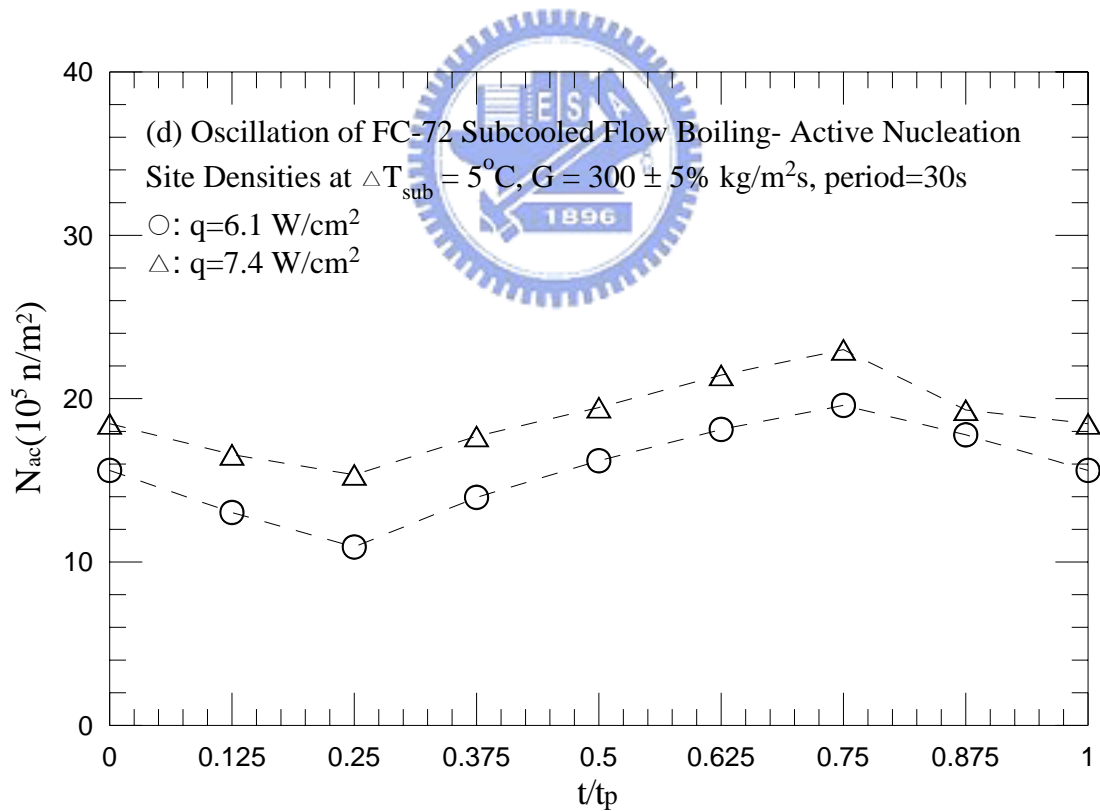
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Fig. 5.166 Mean active nucleation site densities for various imposed heat fluxes for transient subcooled flow boiling for G=300±10% kg/m^{2}s and ΔT_{sub} =5°C with t_p=10 sec (a), 20sec (b) and 30 sec (c).
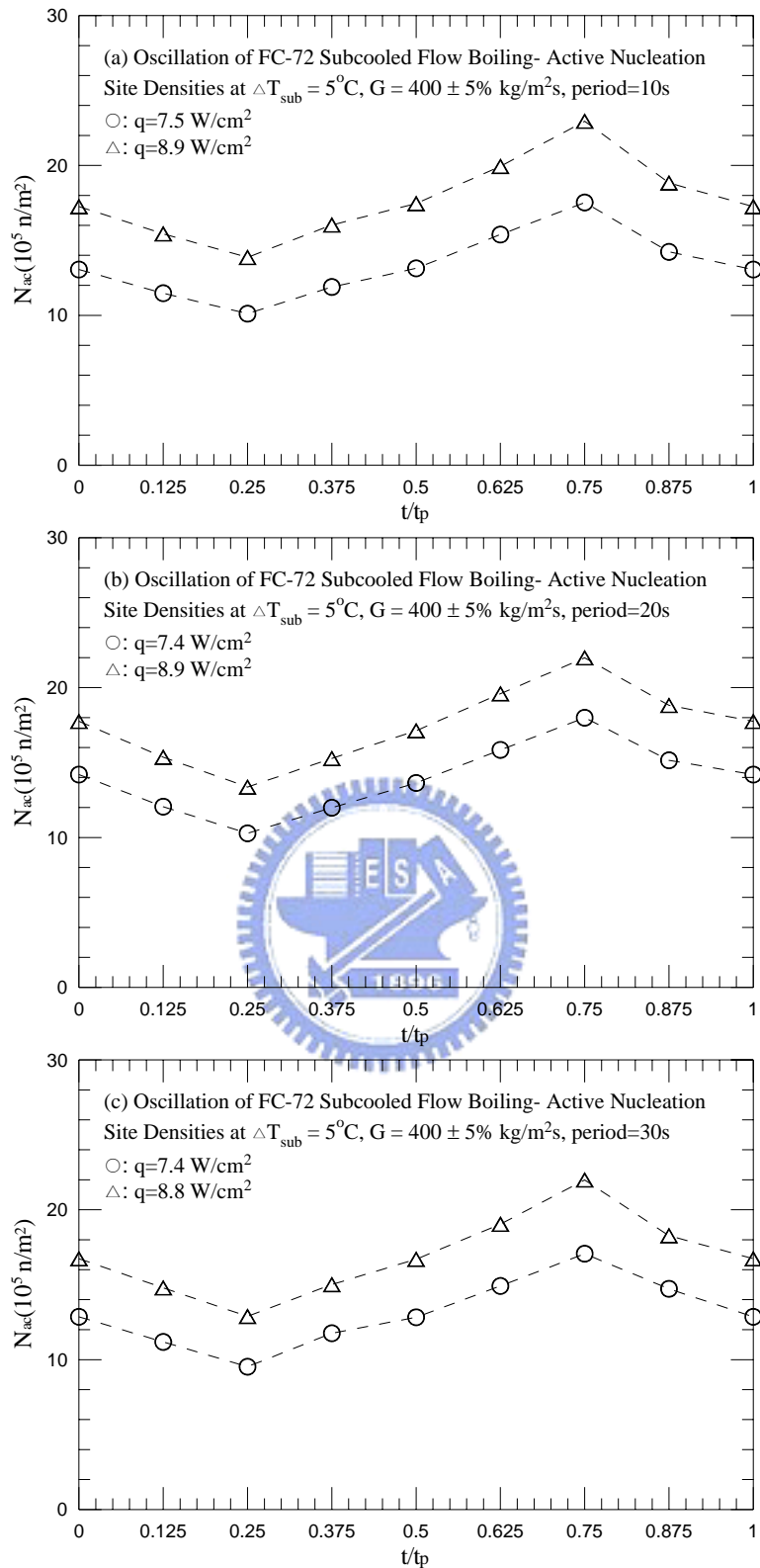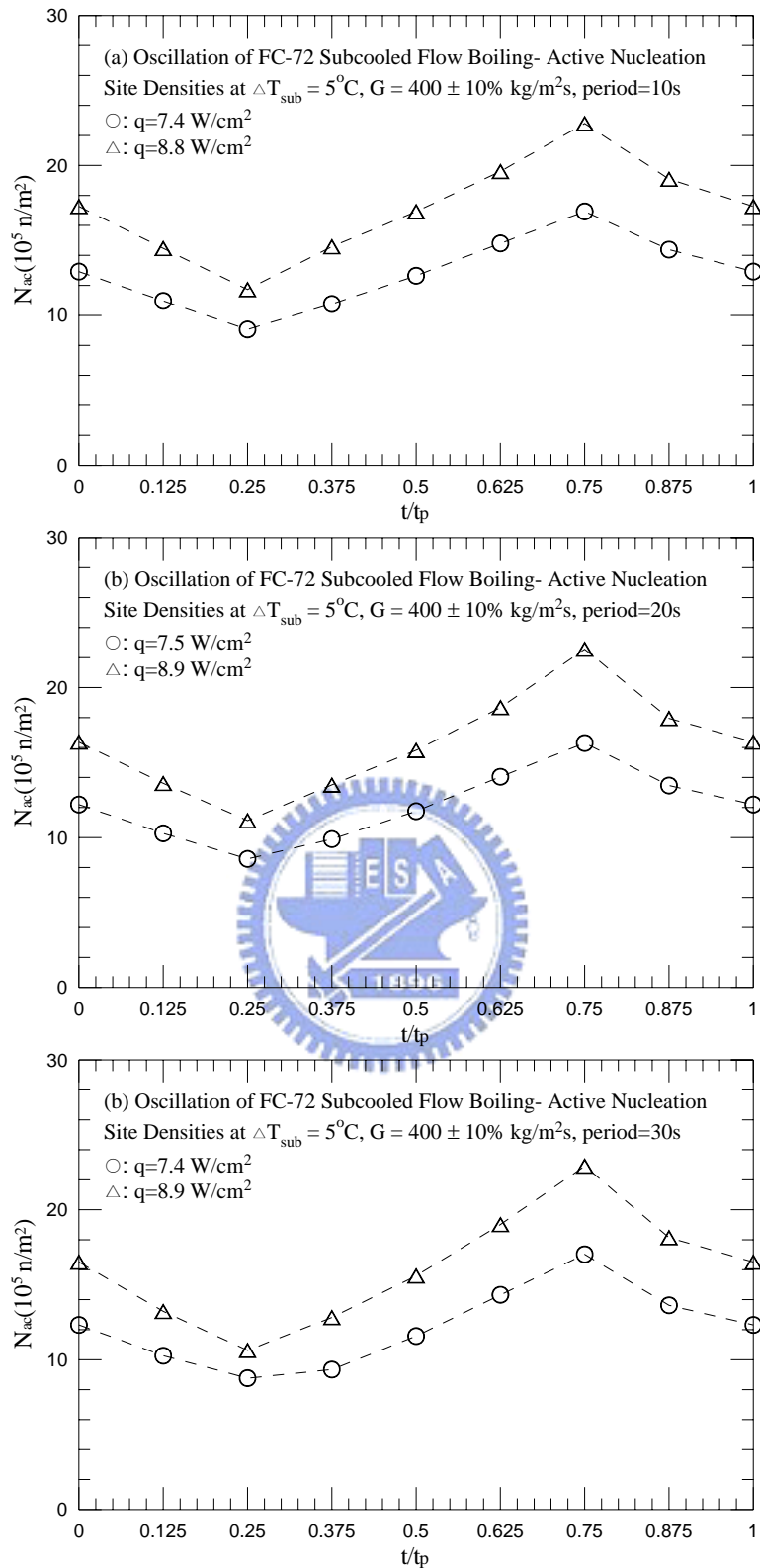
Fig. 5.167 Mean active nucleation site densities for various imposed heat fluxes for transient subcooled flow boiling for G=400±5% kg/m²s and ΔT_{sub} =5°C with t_p=10 sec (a), 20sec (b) and 30 sec (c).

Fig. 5.168 Mean active nucleation site densities for various imposed heat fluxes for transient subcooled flow boiling for G=400±10% kg/m^{2}s and ΔT_{sub} =5°C with t$_p$=10 sec (a), 20sec (b) and 30 sec (c).
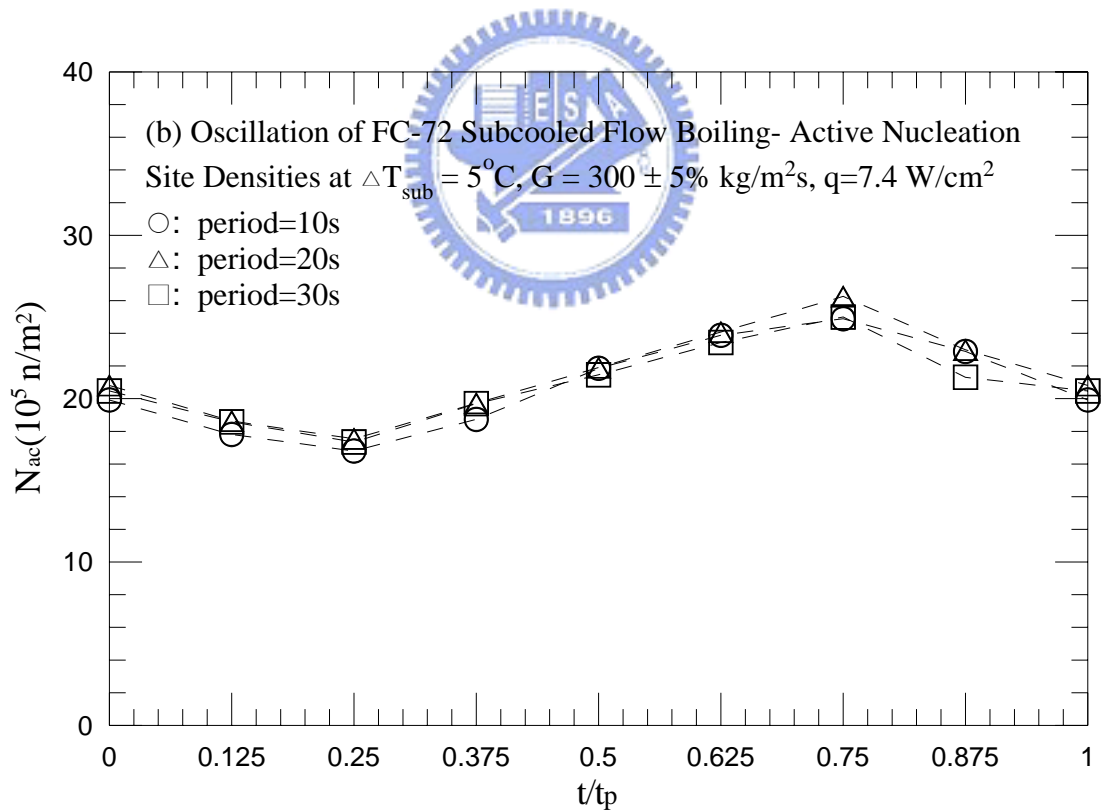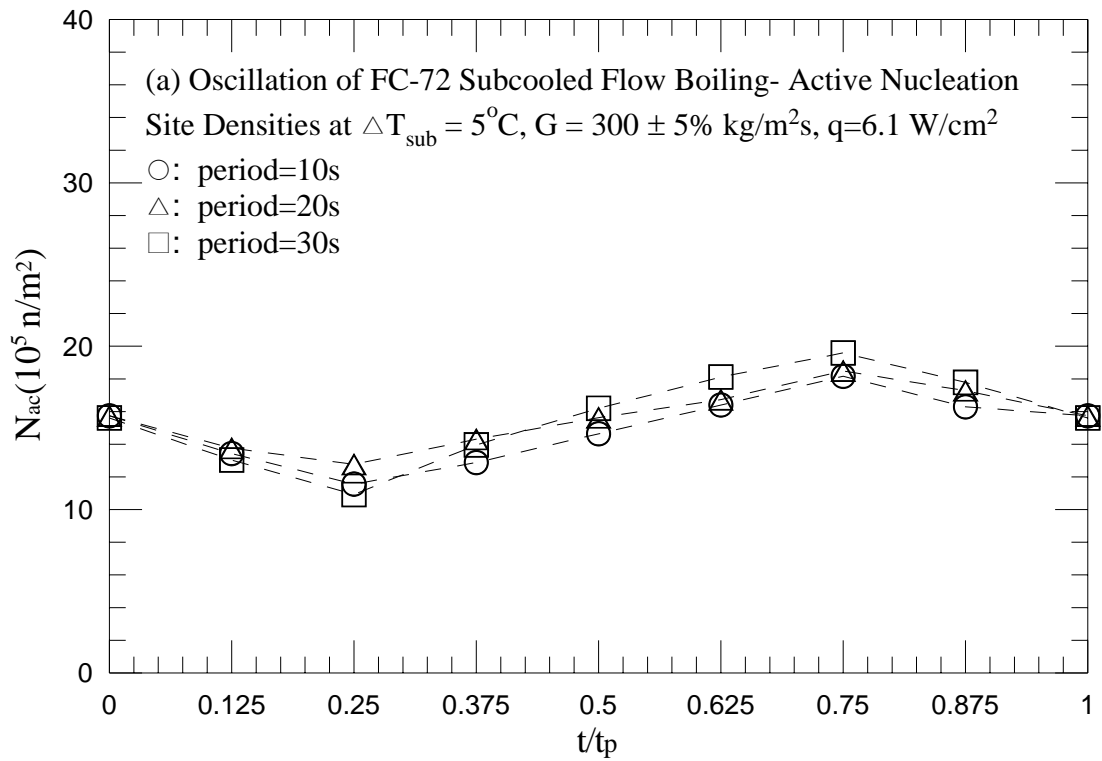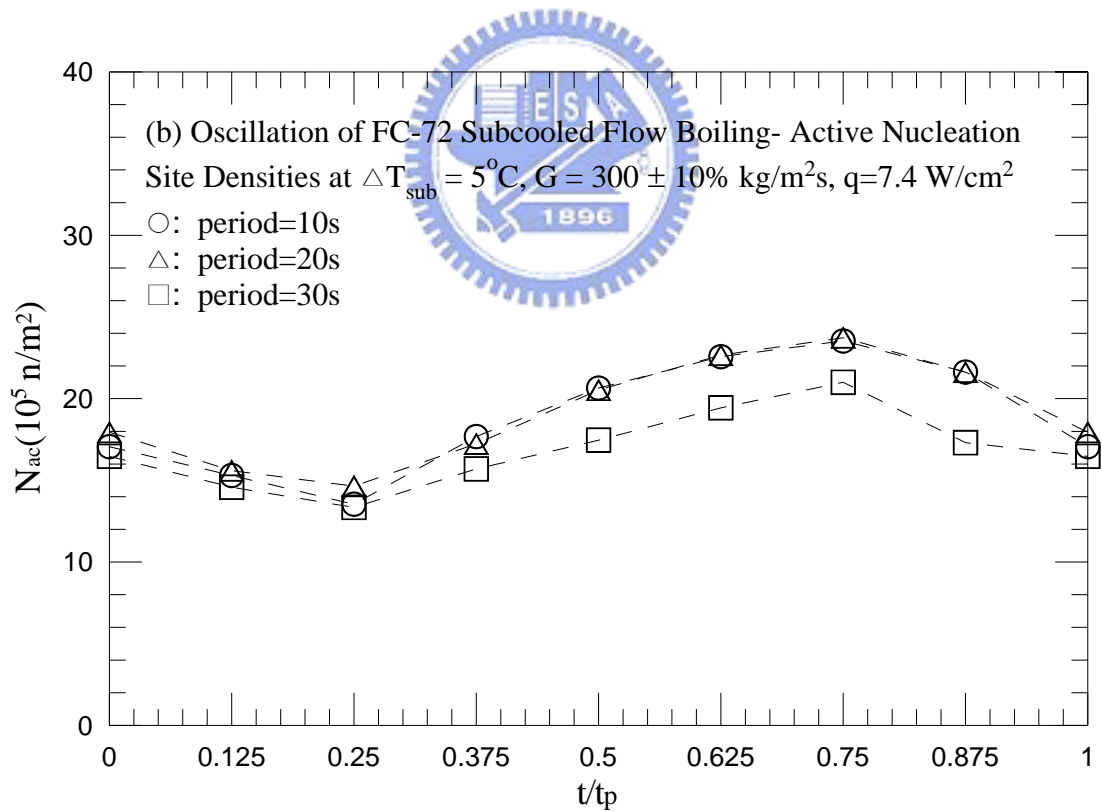
Fig. 5.169 Mean active nucleation site densities for various periods of mass flux oscillation for transient subcooled flow boiling for G=300±5% kg/m²s and $\triangle T_{sub}$ =5°C with (a) q=6.1 W/cm² and (b) q=7.4 W/cm².
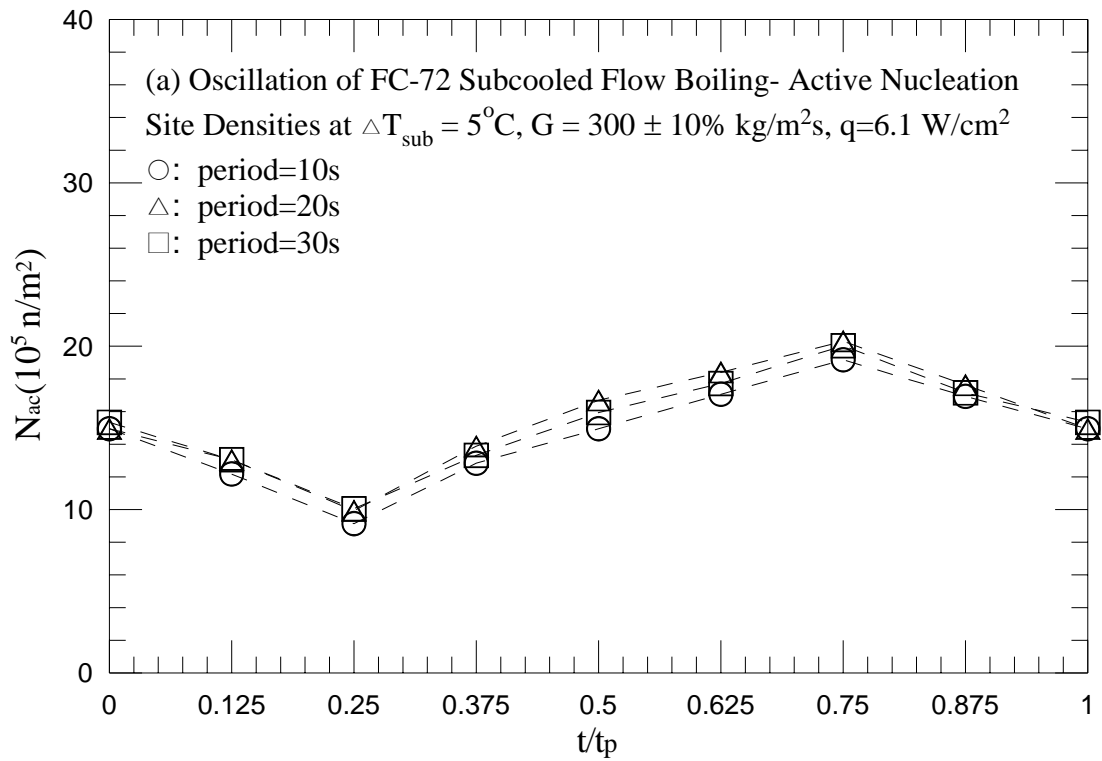
Fig. 5.170 Mean active nucleation site densities for various periods of mass flux oscillation for transient subcooled flow boiling for G=300±10% kg/m²s and ΔT_{sub} =5°C with (a) q=6.1 W/cm² and (b) q=7.4 W/cm².
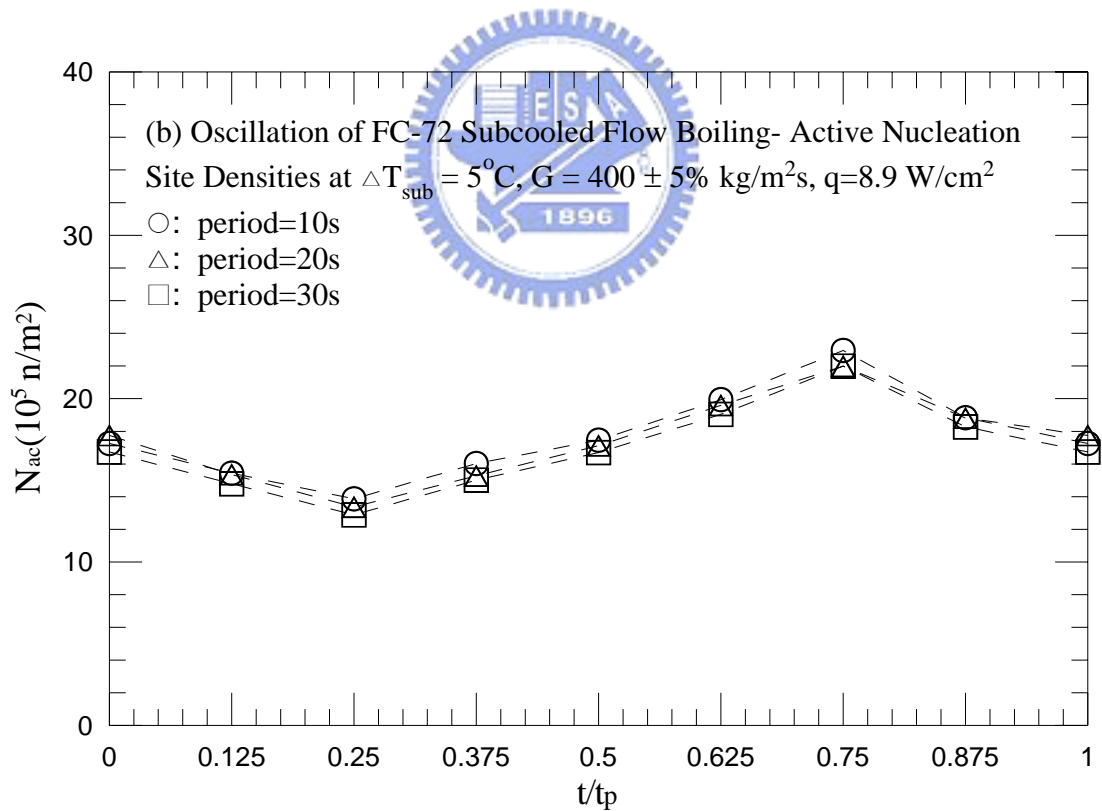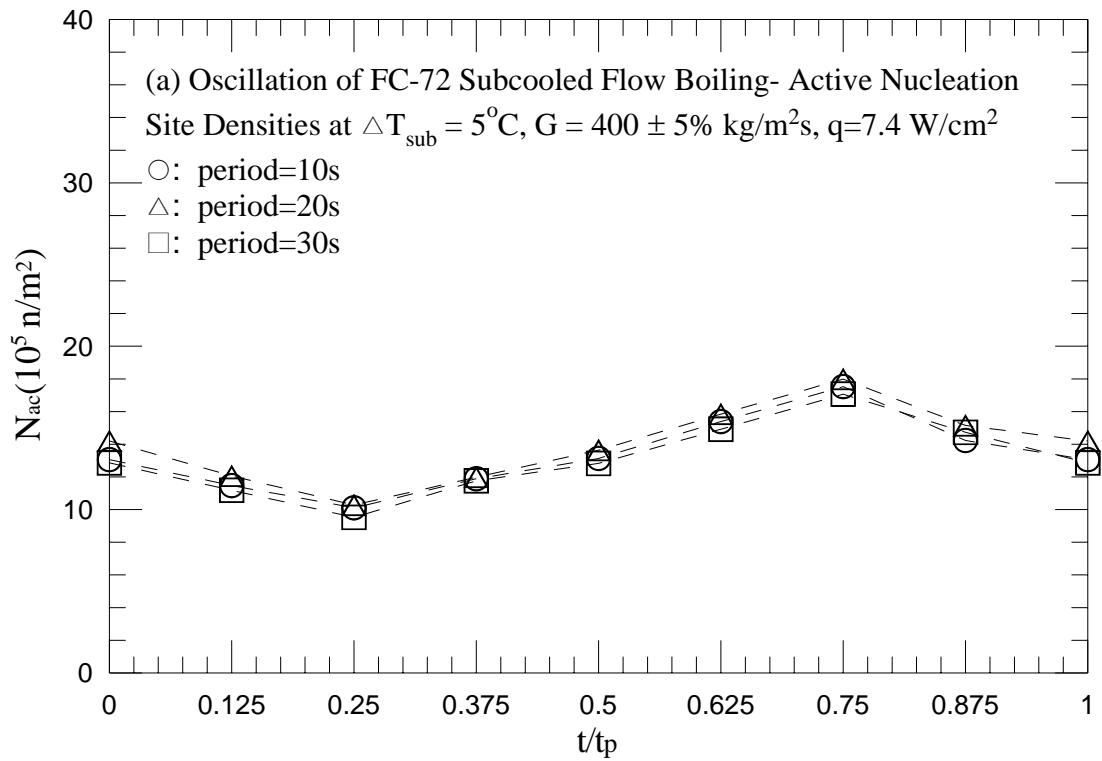
Fig. 5.171 Mean active nucleation site densities for various periods of mass flux oscillation for transient subcooled flow boiling for G=400±5% kg/m^{2}s and $\triangle T_{sub}$ =5°C with (a) q=7.4 W/cm^2 and (b) q=8.9 W/cm^2.
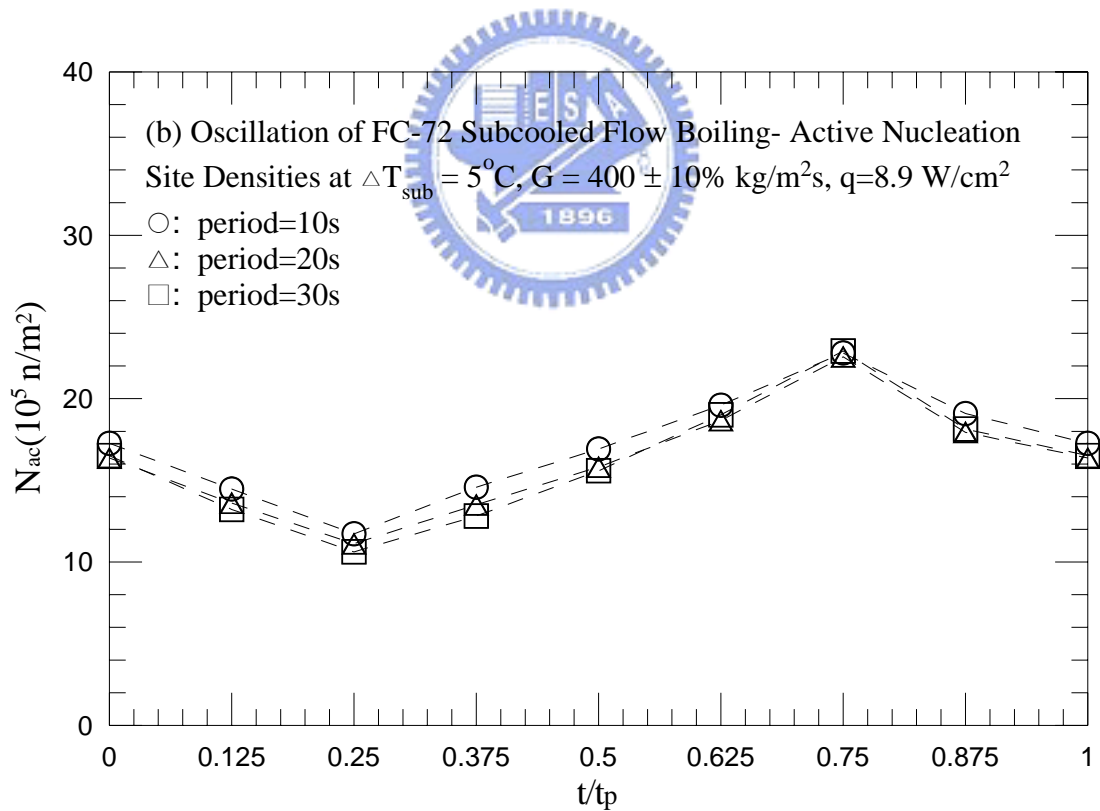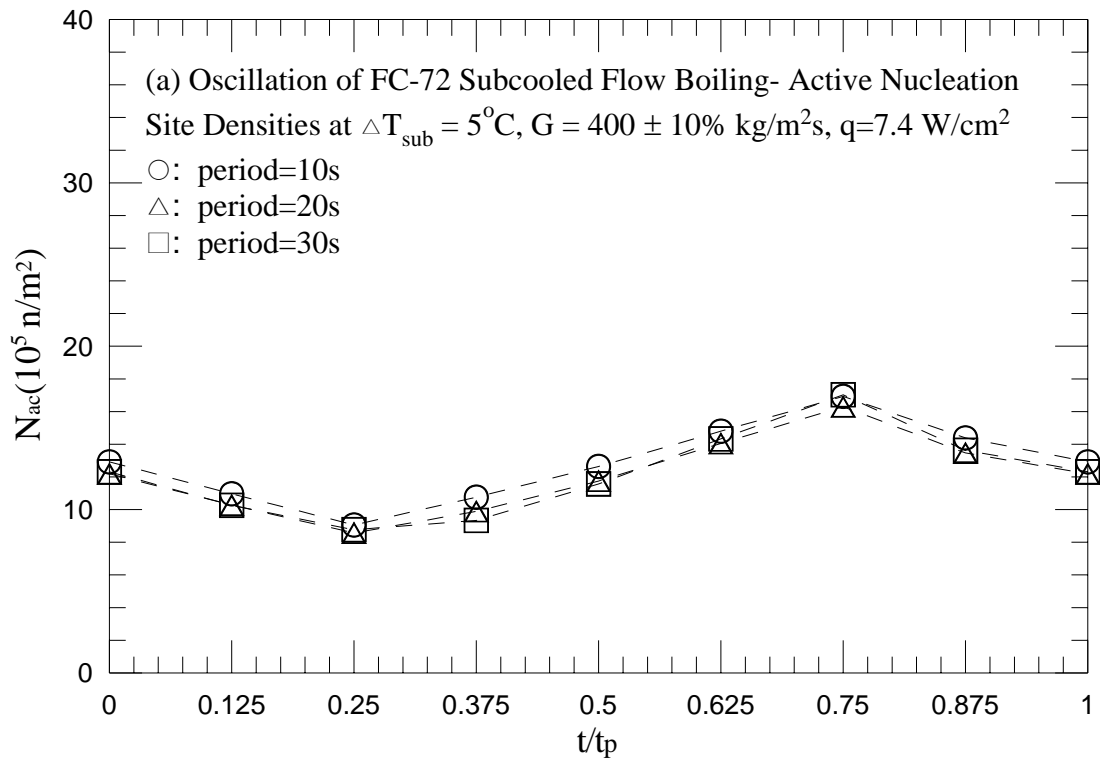
Fig. 5.172 Mean active nucleation site densities for various periods of mass flux oscillation for transient subcooled flow boiling for G=400±10% kg/m²s and ΔT_{sub} =5°C with (a) q=7.4 W/cm² and (b) q=8.9 W/cm².
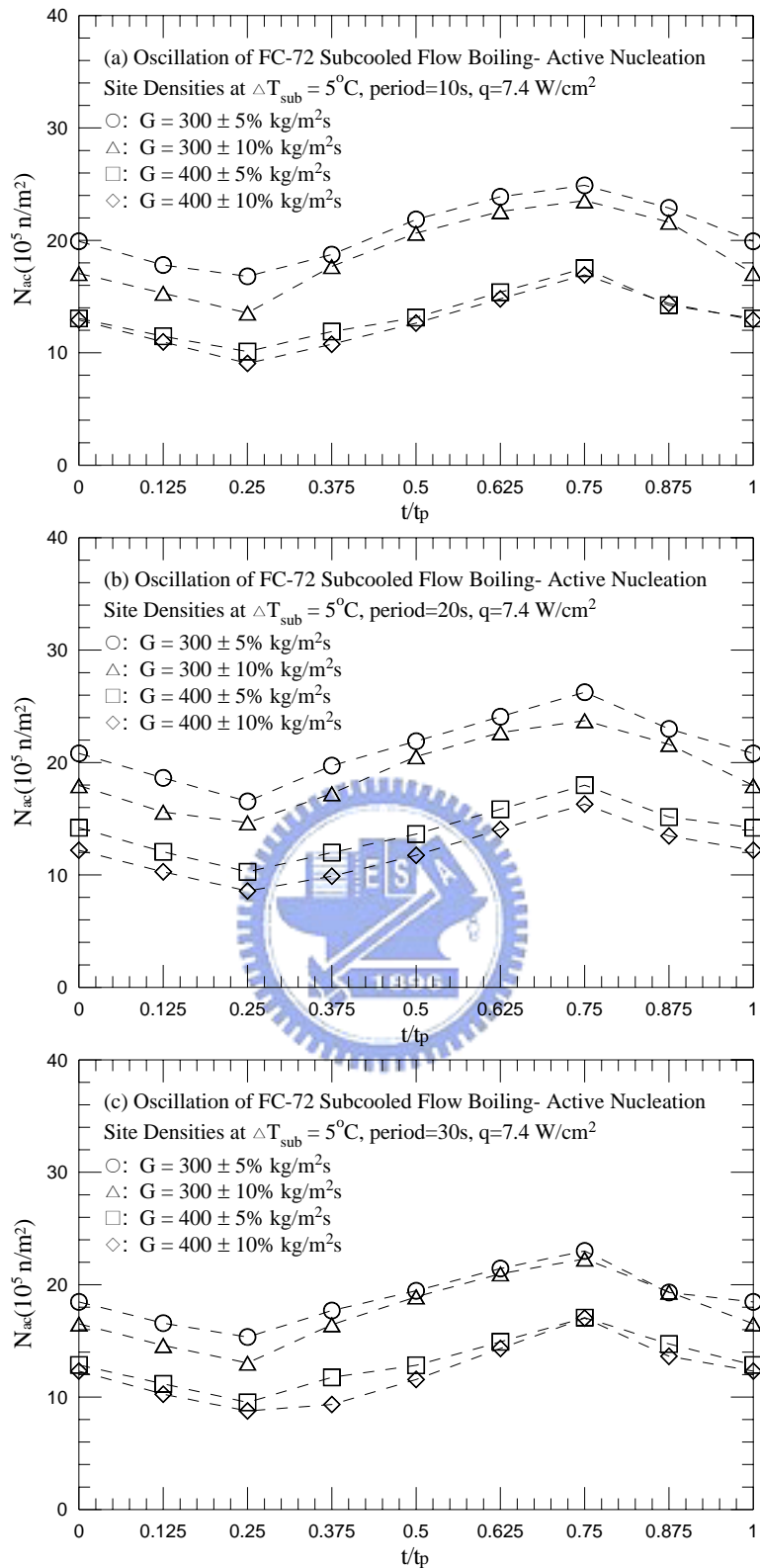
Fig. 5.173 Mean active nucleation site densities for various amplitudes of the mass fluxes oscillation for transient subcooled flow boiling for q=7.4 and ΔT_{sub} =5°C W/cm^2 with period=10 sec (a), 20 sec (b), and 30 sec (c).
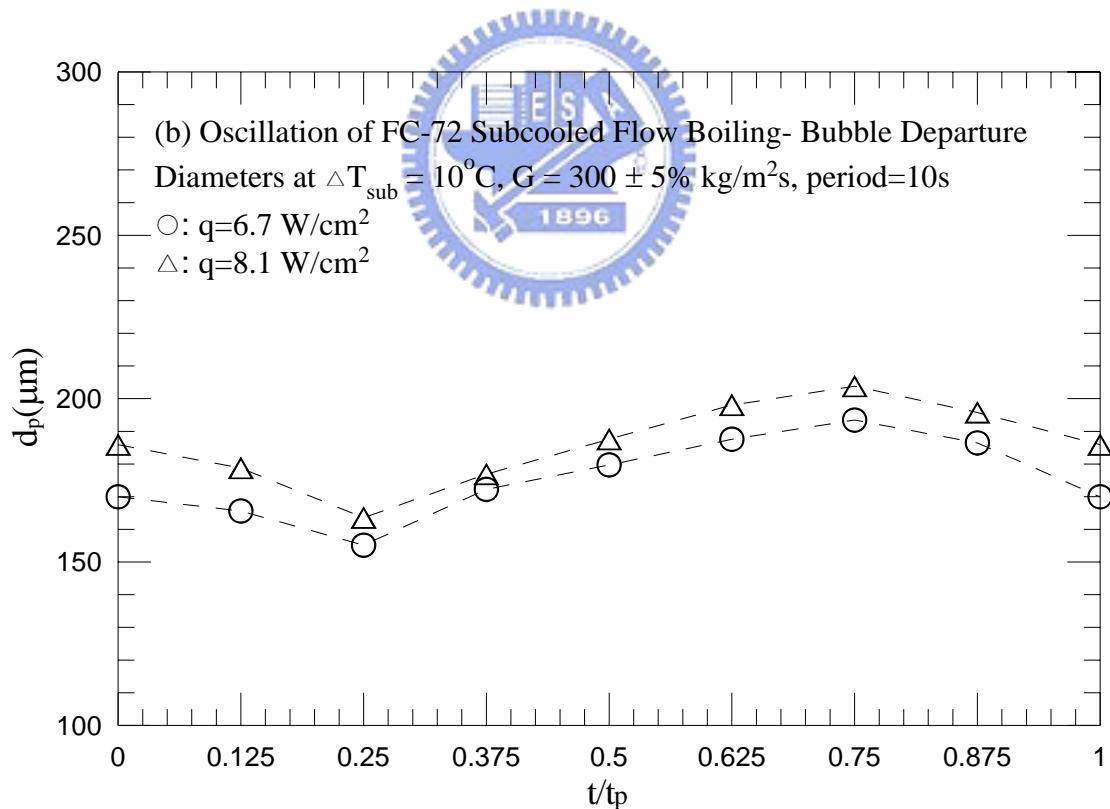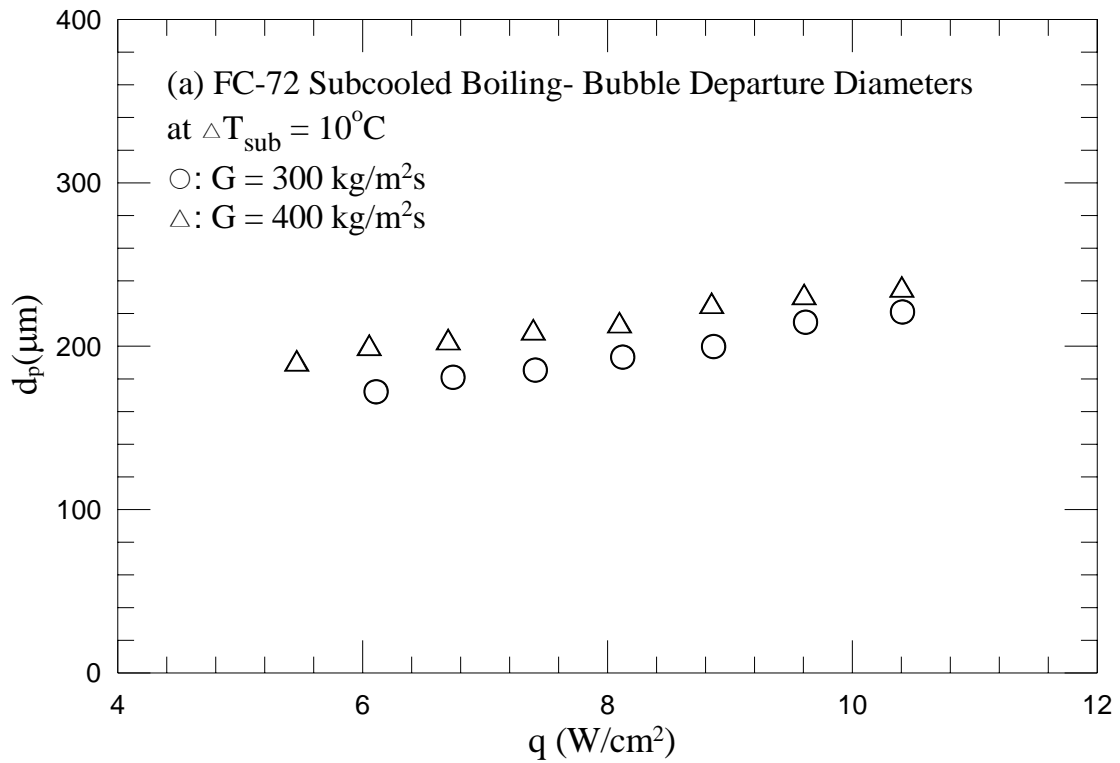
Fig. 5.174 Mean bubble departure diameters for various coolant mass fluxes for stable subcooled flow boiling (a) and various imposed heat fluxes for transient subcooled flow boiling for G=300±5% kg/m^{2}s and $\triangle T_{sub}$ =10°C with t$_p$=10 sec (b), 20sec (c) and 30 sec (d).

(c) Oscillation of FC-72 Subcooled Flow Boiling- Bubble Departure Diameters at $\triangle T_{sub} = 10^{o}C$, G = 300 ± 5% kg/m²s, period=20s
○: q=6.7 W/cm²
△: q=8.1 W/cm²

(d) Oscillation of FC-72 Subcooled Flow Boiling- Bubble Departure Diameters at $\triangle T_{sub} = 10^{o}C$, G = 300 ± 5% kg/m²s, period=30s
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△: q=8.0 W/cm²
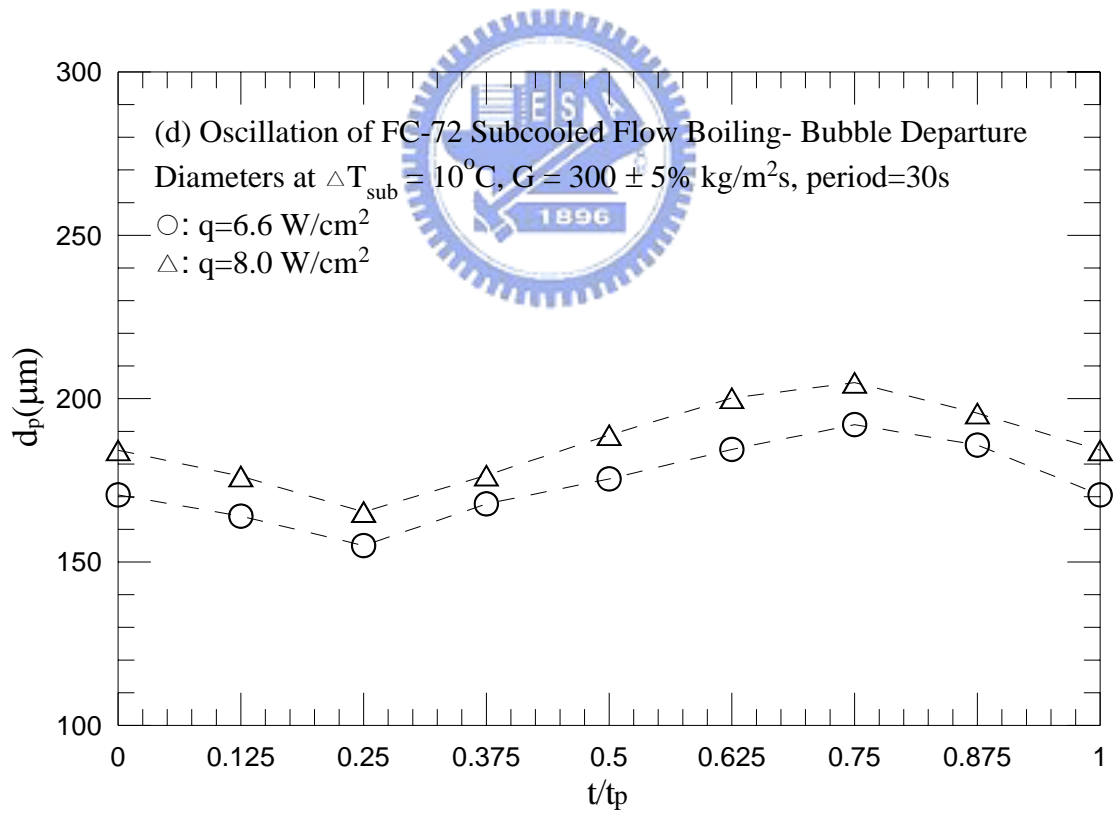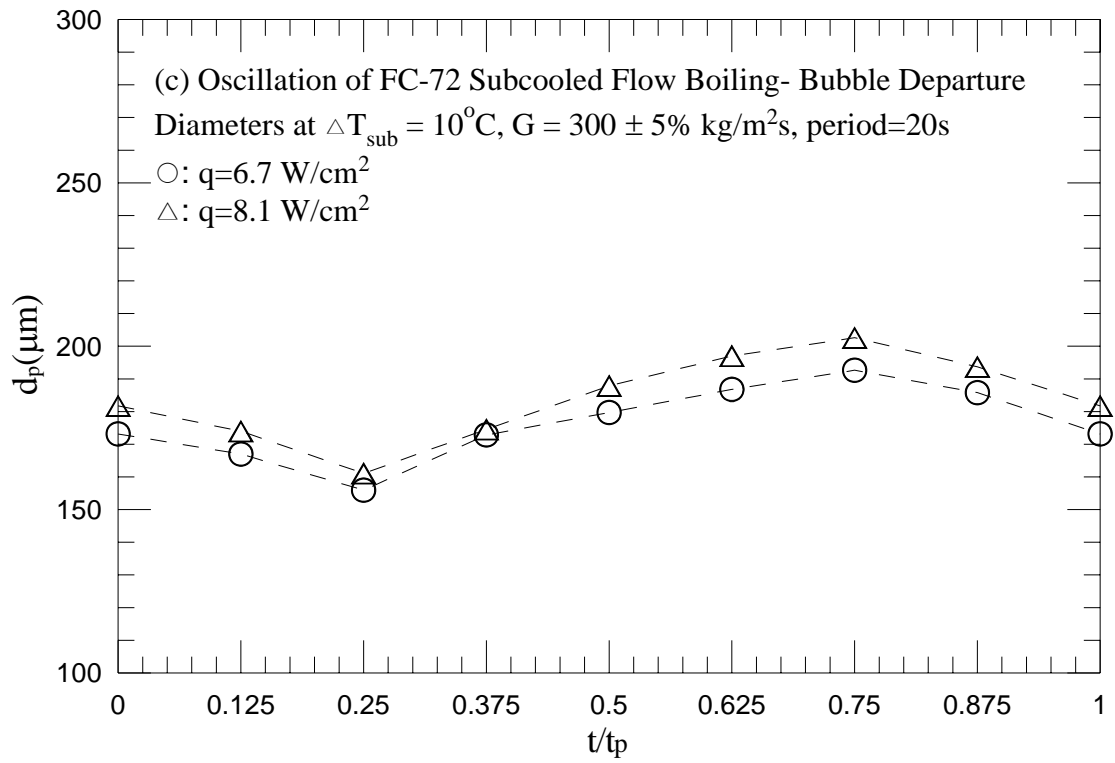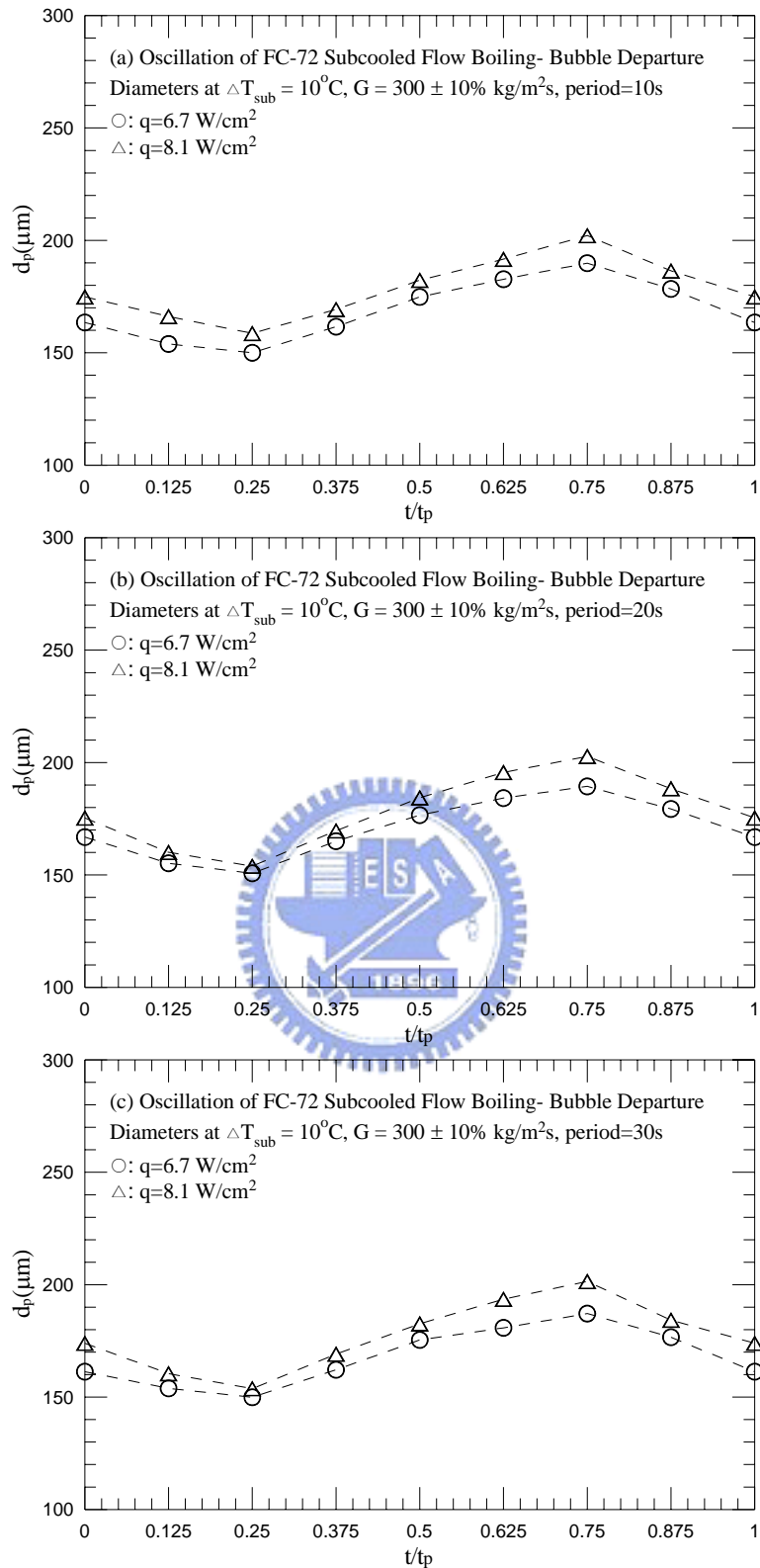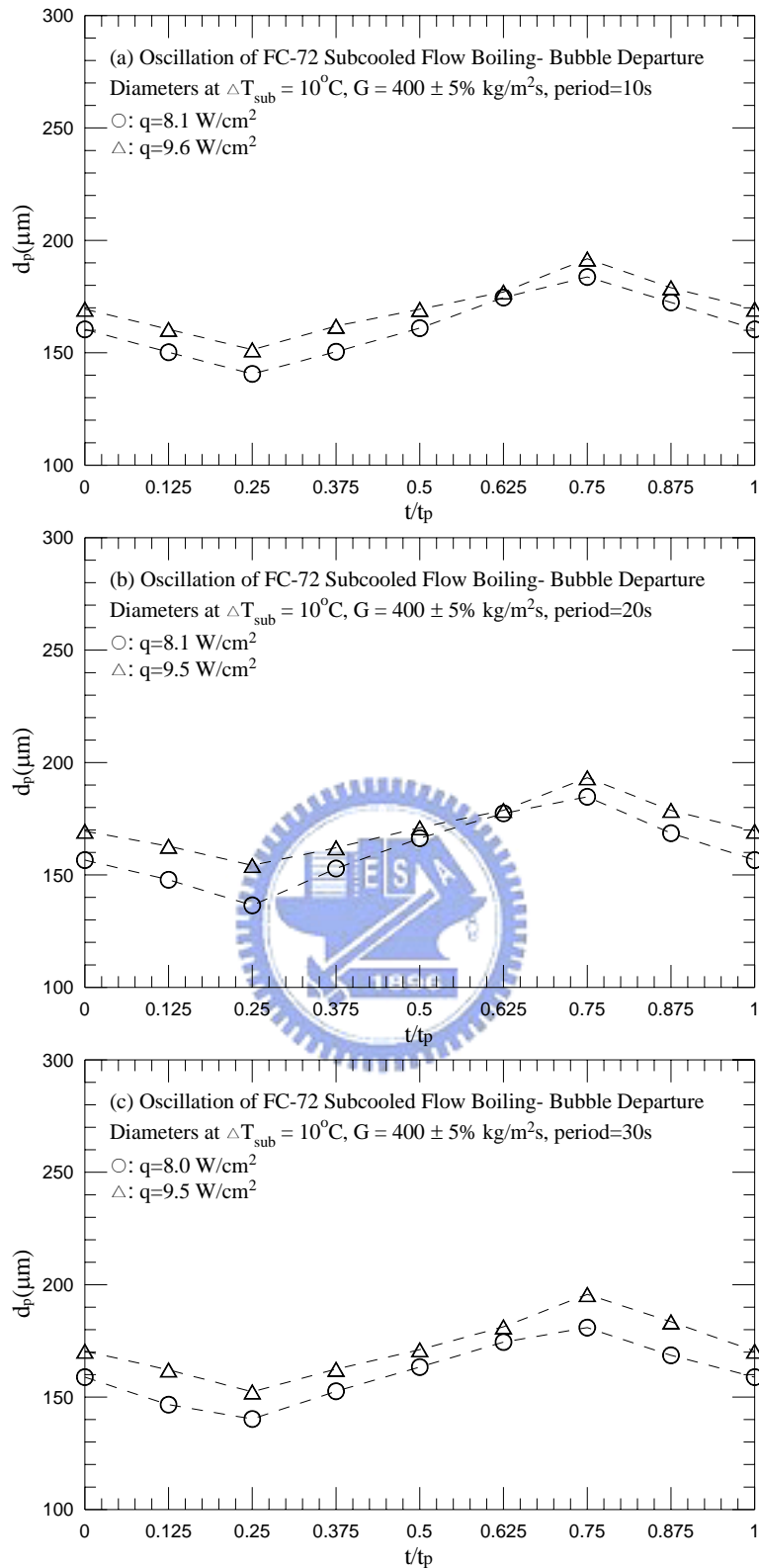
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Fig. 5.175 Mean bubble departure diameters for various imposed heat fluxes for transient subcooled flow boiling for G=300±10% kg/m^{2}s and ΔT_{sub} =10°C with t$_p$=10 sec (a), 20sec (b) and 30 sec (c).

Fig. 5.176 Mean bubble departure diameters for various imposed heat fluxes for transient subcooled flow boiling for G=400±5% kg/m^{2}s and ΔT_{sub} =10°C with t$_p$=10 sec (a), 20sec (b) and 30 sec (c).
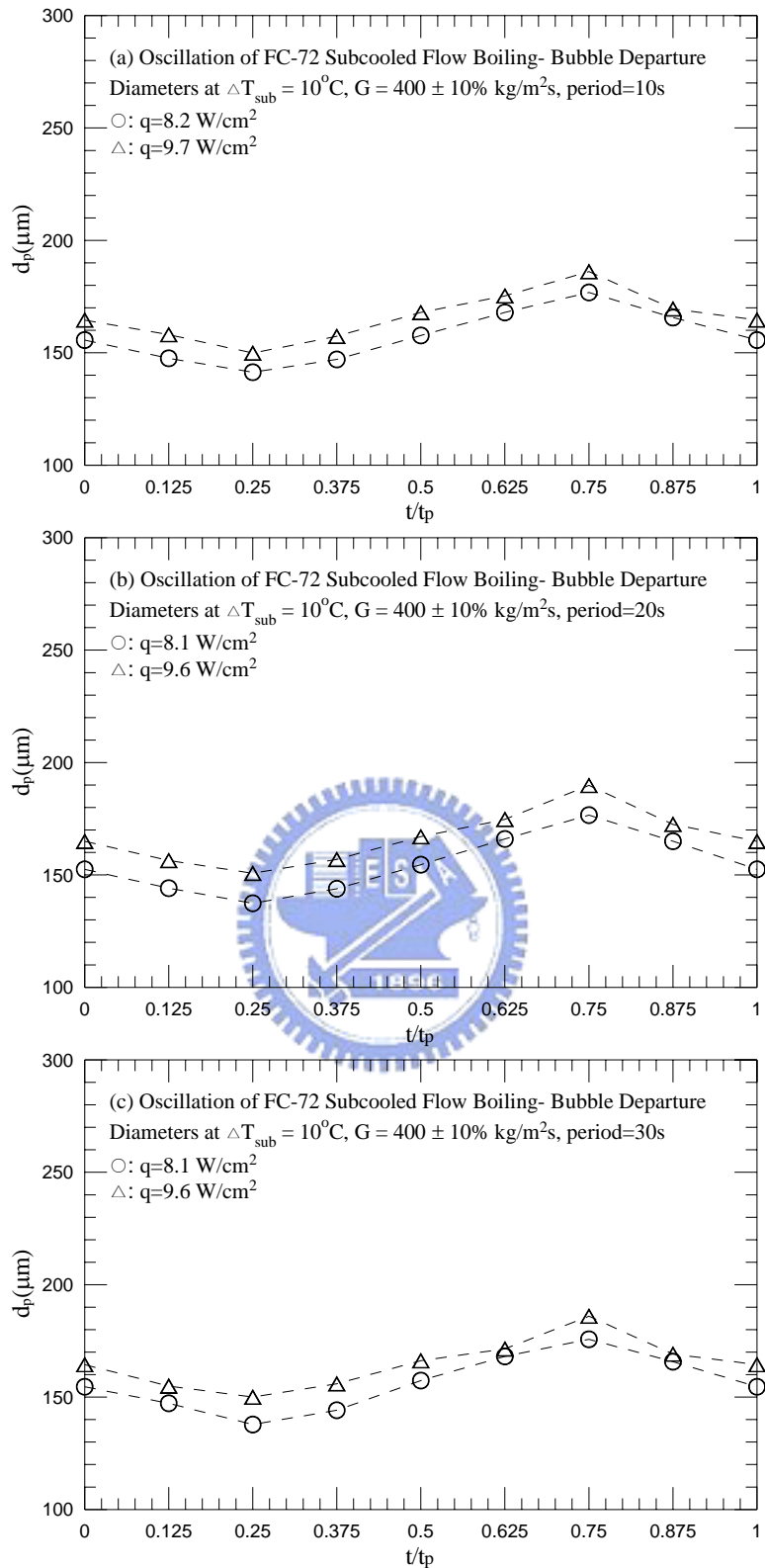
Fig. 5.177 Mean bubble departure diameters for various imposed heat fluxes for transient subcooled flow boiling for G=400±10% kg/m^{2}s and $\triangle T_{sub}$ =10°C with t$_p$=10 sec (a), 20sec (b) and 30 sec (c).
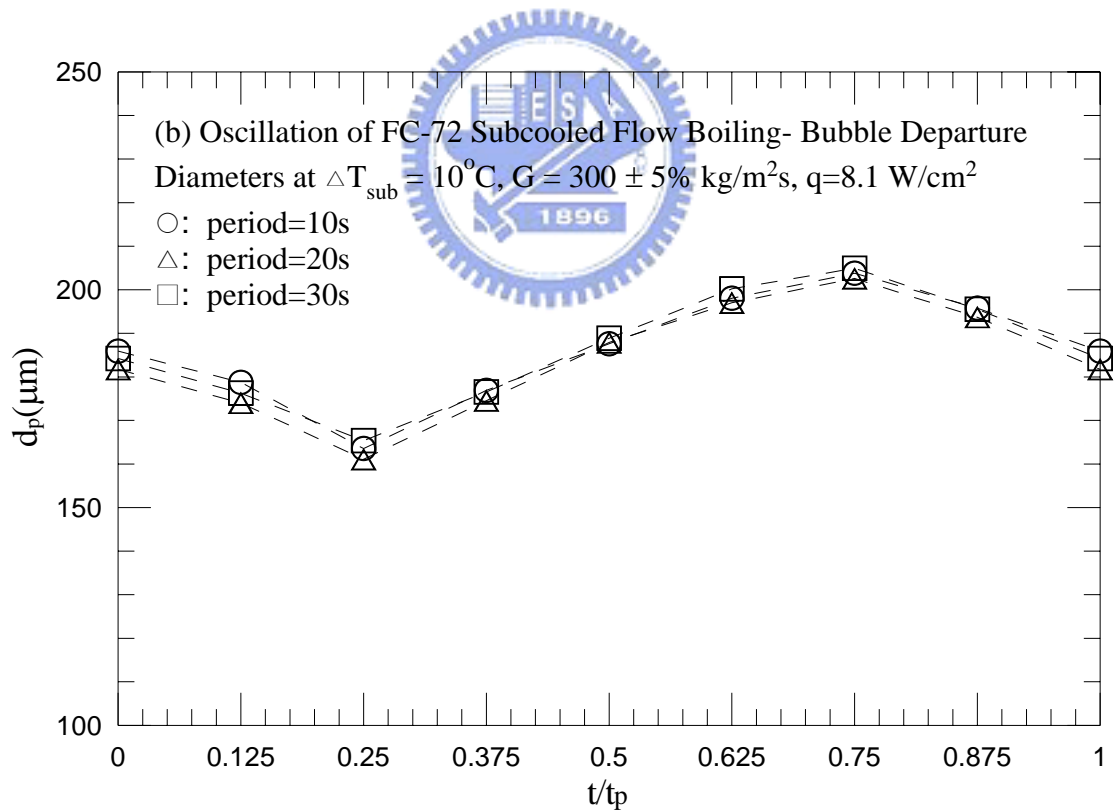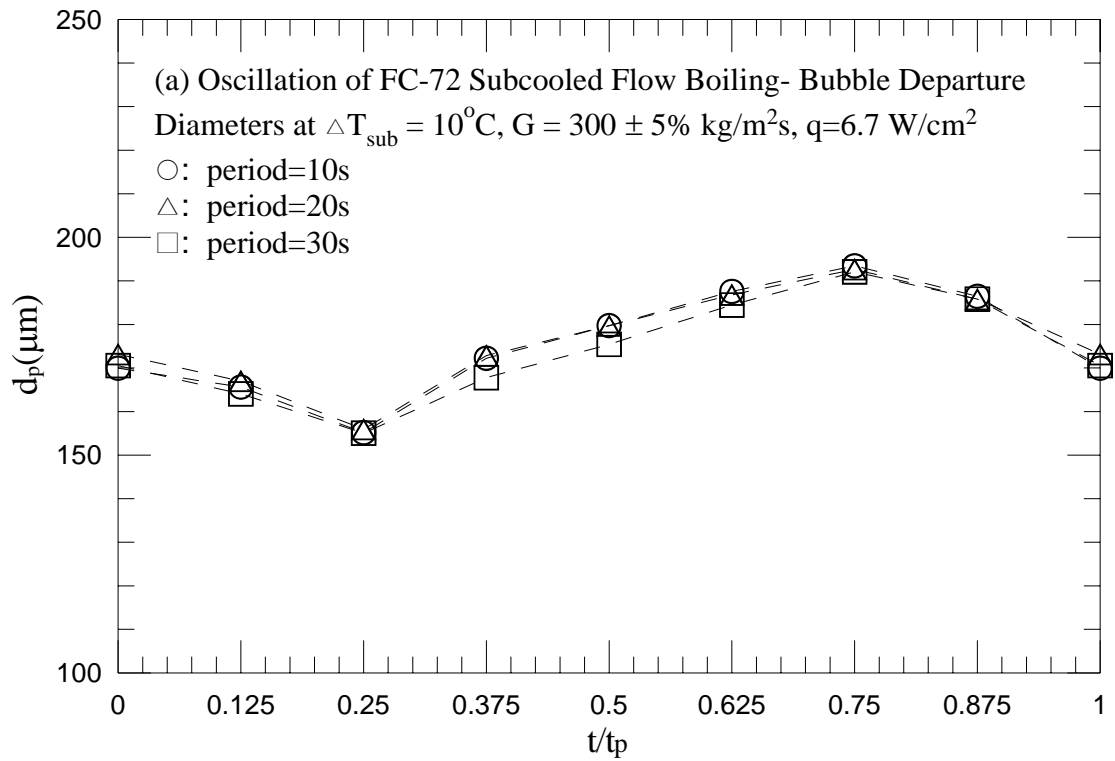
Fig. 5.178 Mean bubble departure diameters for various period of mass flux oscillation for transient subcooled flow boiling for G=300±5% kg/m²s and ΔT_{sub} =10°C with (a) q=6.7 W/cm² and (b) q=8.1 W/cm².
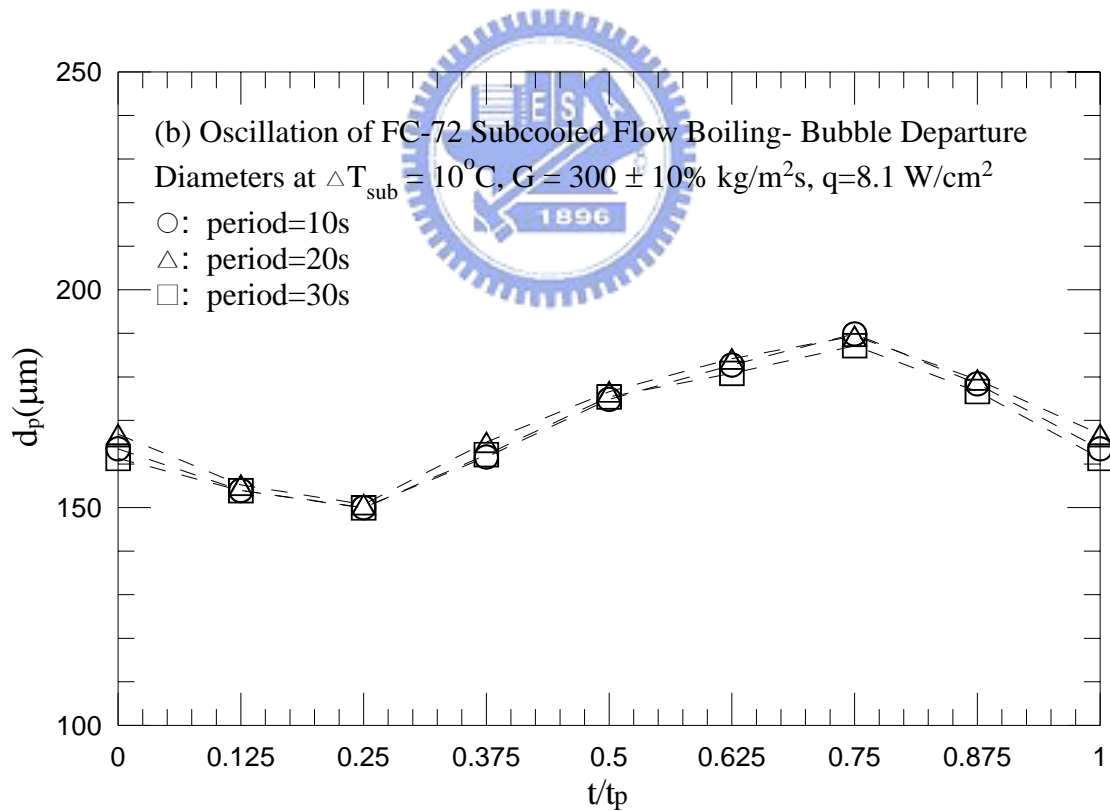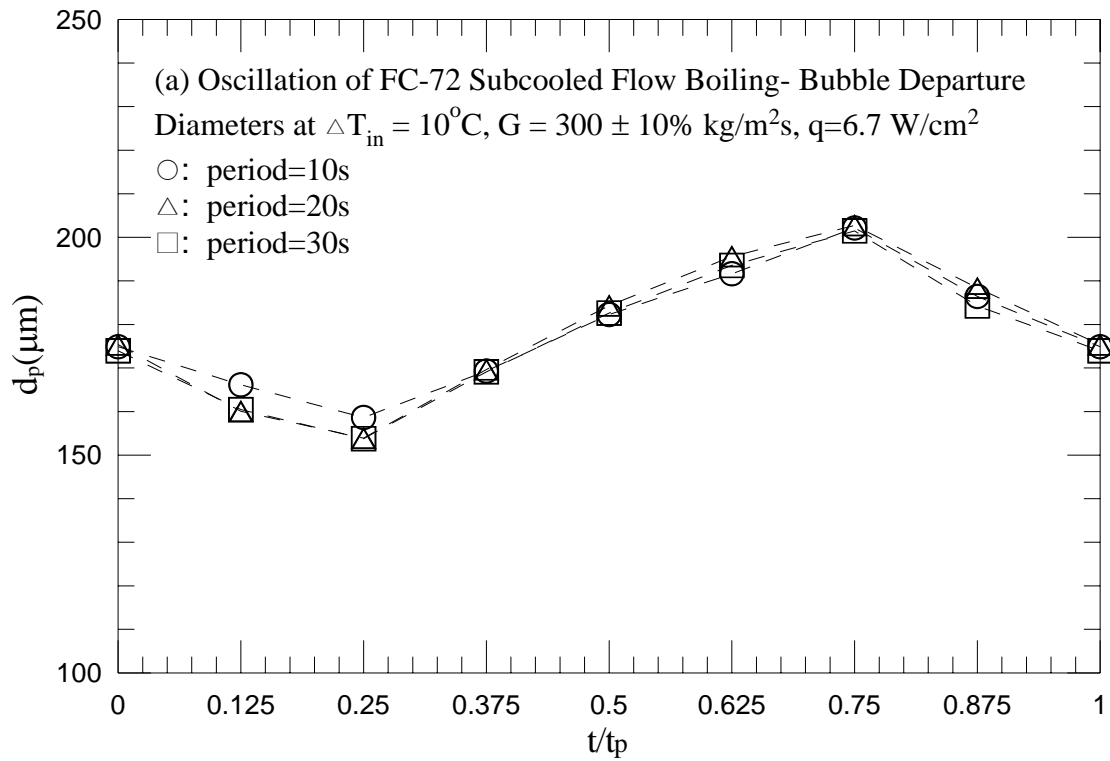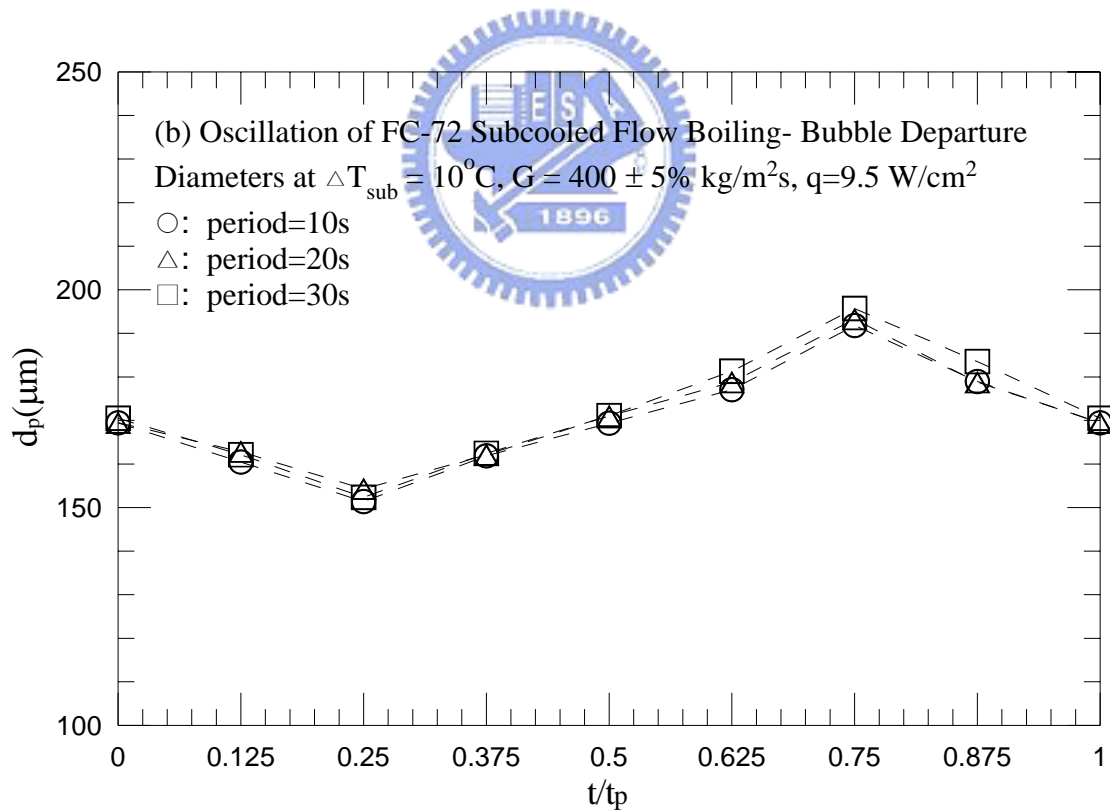
Fig. 5.179 Mean bubble departure diameters for various period of mass flux oscillation for transient subcooled flow boiling for G=300±10% kg/m^{2}s and ΔT_{sub} =10°C with (a) q=6.7 W/cm^2 and (b) q=8.1 W/cm^2.

Fig. 5.180 Mean bubble departure diameters for various period of mass flux oscillation for transient subcooled flow boiling for G=400±5% kg/m²s and ΔT_{sub} =10°C with (a) q=8.1 W/cm² and (b) q=9.5 W/cm².
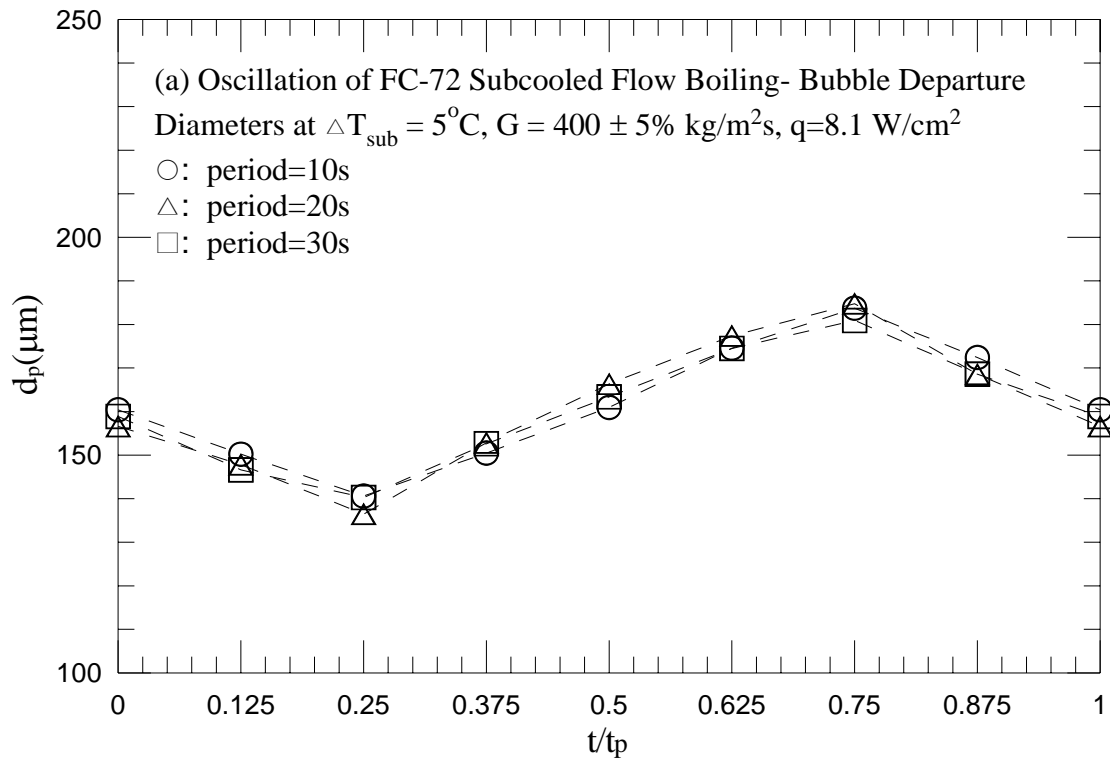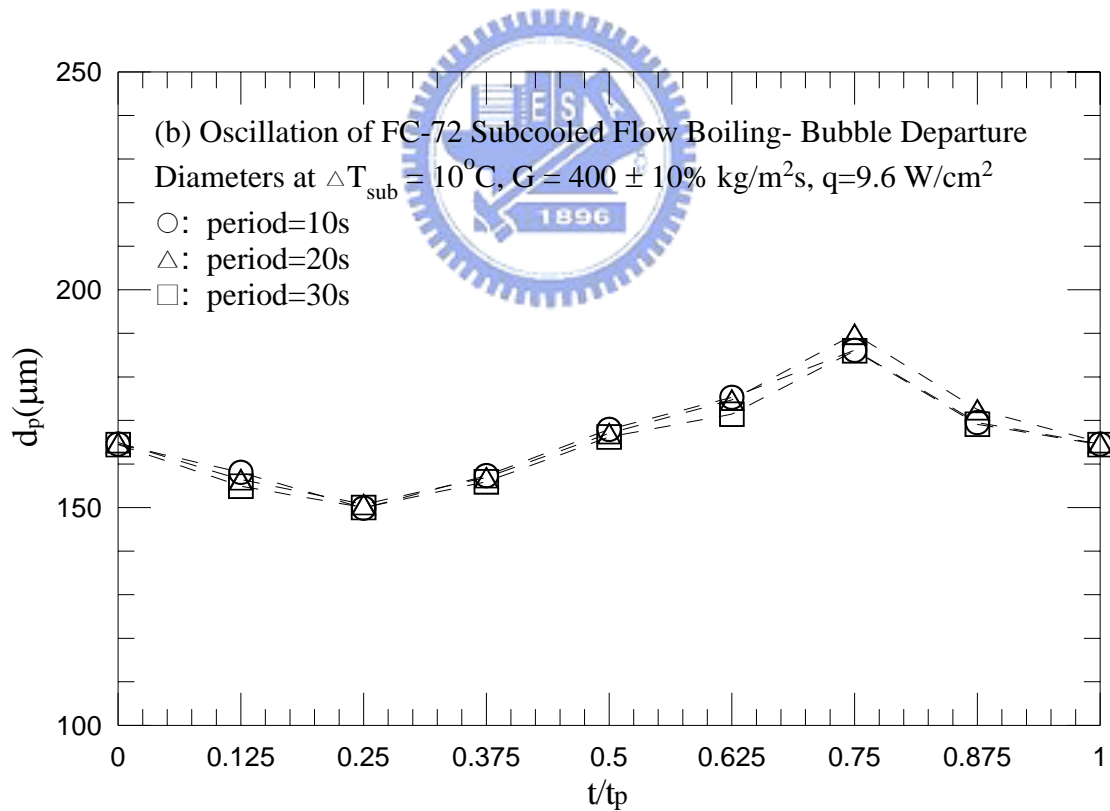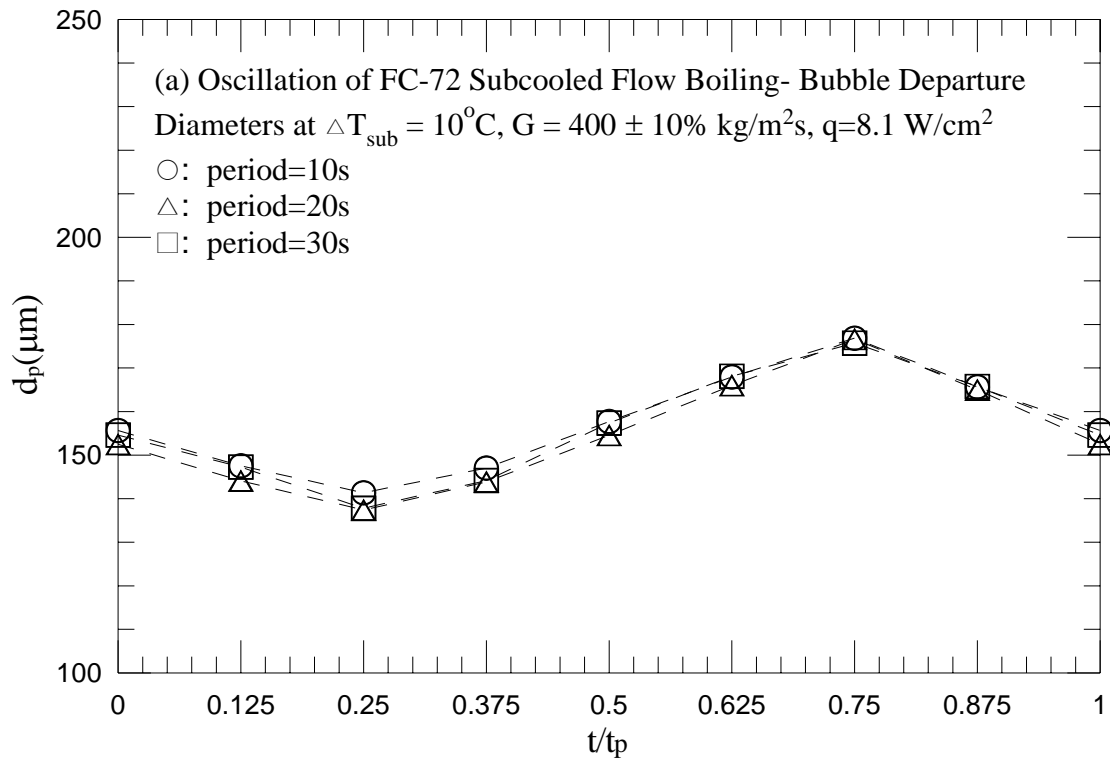
357

Fig. 5.181 Mean bubble departure diameters for various period of mass flux oscillation for transient subcooled flow boiling for $G=400\pm10\%$ kg/m^{2}s and ΔT_{sub} $=10^o$C with (a) q=8.1 W/cm^2 and (b) q=9.6 W/cm^2.
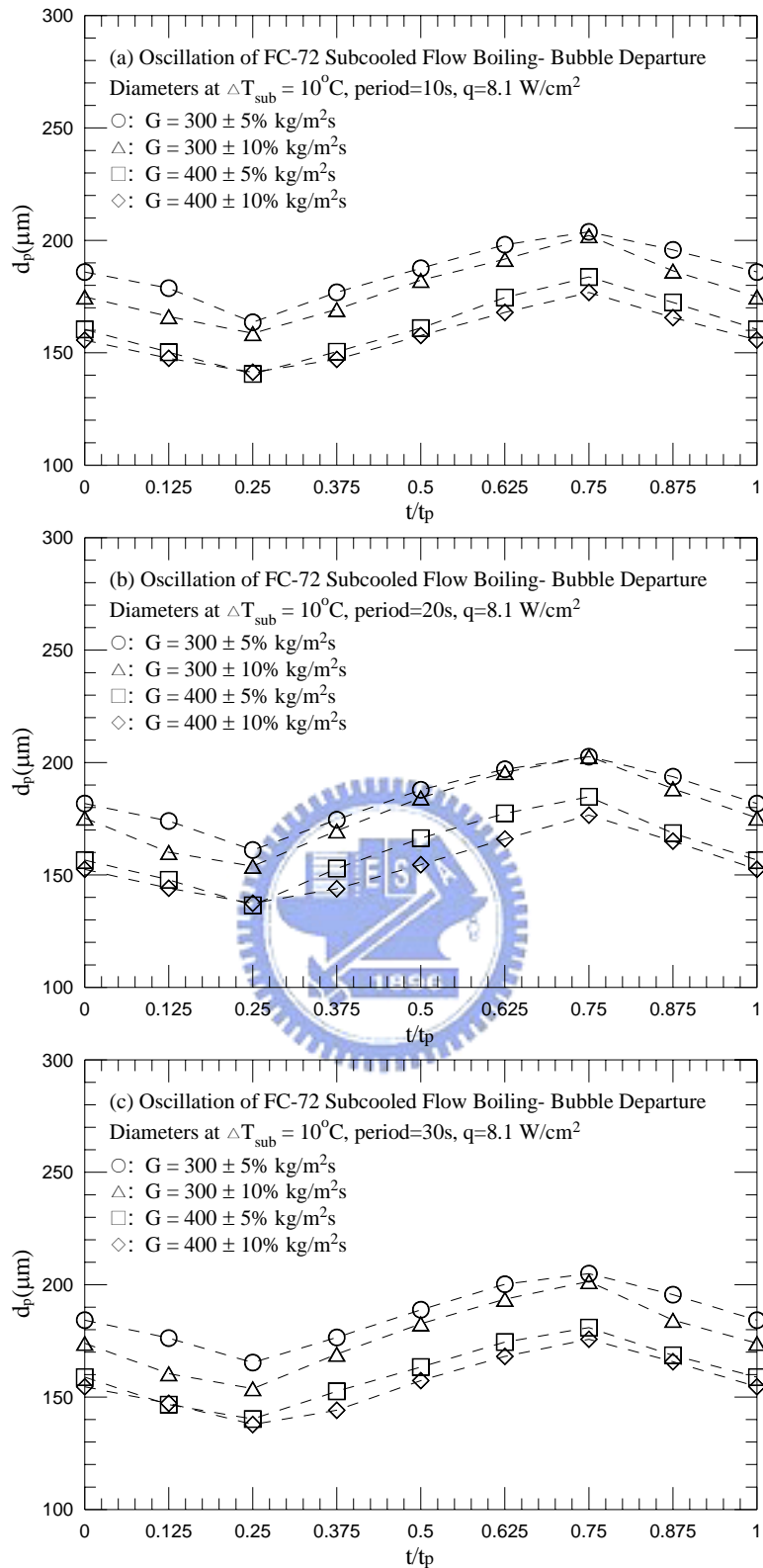
Fig. 5.182 Mean bubble departure diameters for various amplitudes of the mass fluxes oscillation for transient subcooled flow boiling for q=8.1 W/cm^2 and $\triangle T_{sub}$ =10°C with period=10 sec (a), 20 sec (b), and 30 sec (c).
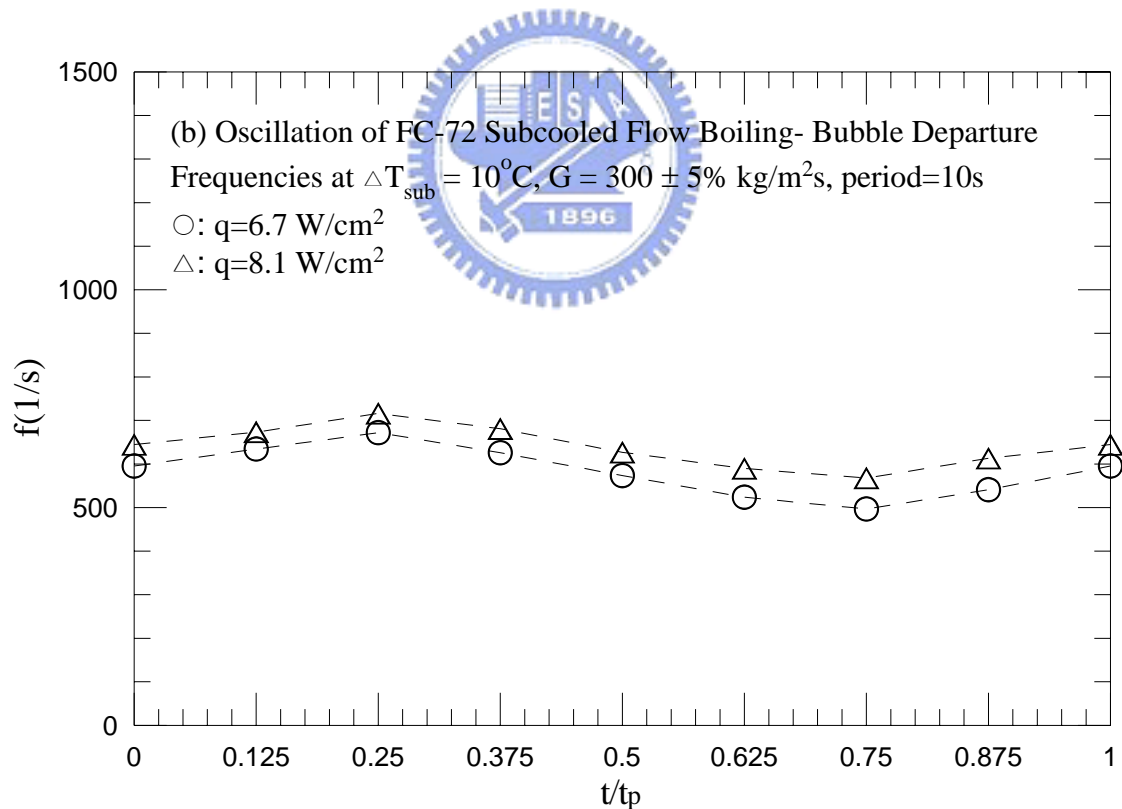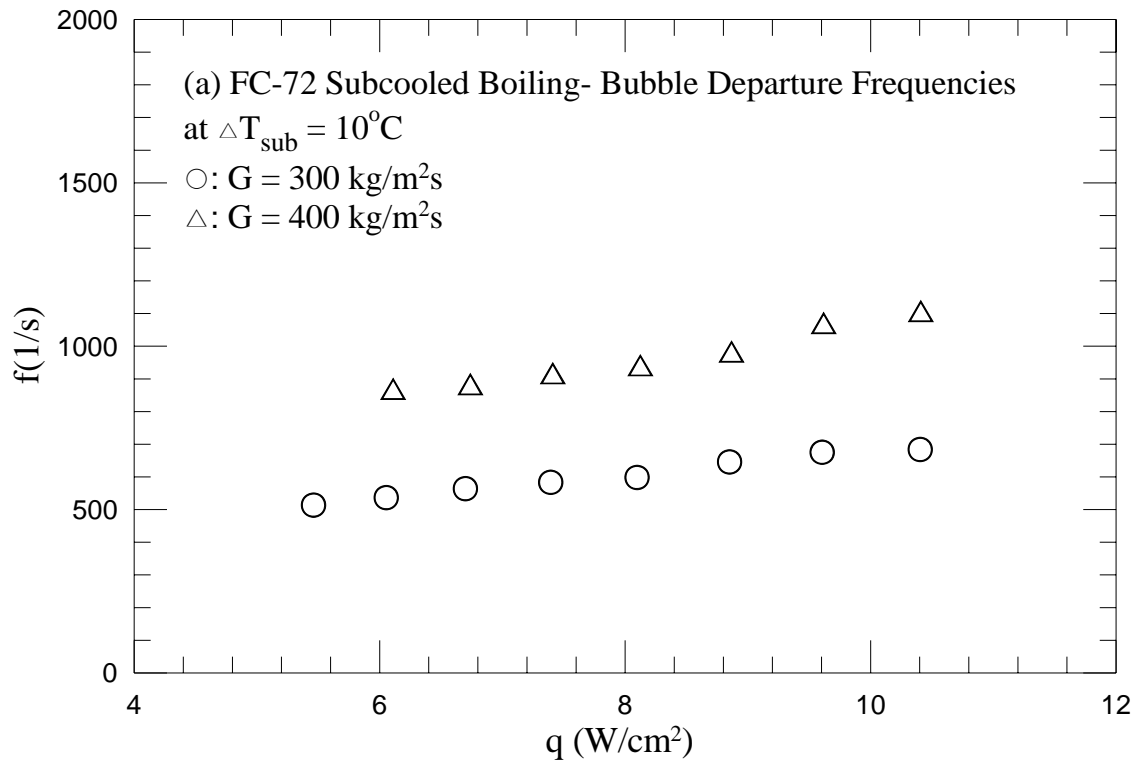
Fig. 5.183 Mean bubble departure frequencies for various coolant mass fluxes for stable subcooled flow boiling (a) and various imposed heat fluxes for transient subcooled flow boiling for $G=300\pm5\%$ kg/m^{2}s and $\triangle T_{sub}$ =10°C with t_p=10 sec (b), 20sec (c) and 30 sec (d).

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(c) Oscillation of FC-72 Subcooled Flow Boiling- Bubble Departure Frequencies at $\triangle T_{sub} = 10\,^{o}C$, $G = 300 \pm 5\%$ kg/m²s, period=20s
○: q=6.7 W/cm²
△: q=8.1 W/cm²

(d) Oscillation of FC-72 Subcooled Flow Boiling- Bubble Departure Frequencies at $\triangle T_{sub} = 10\,^{o}C$, $G = 300 \pm 5\%$ kg/m²s, period=30s
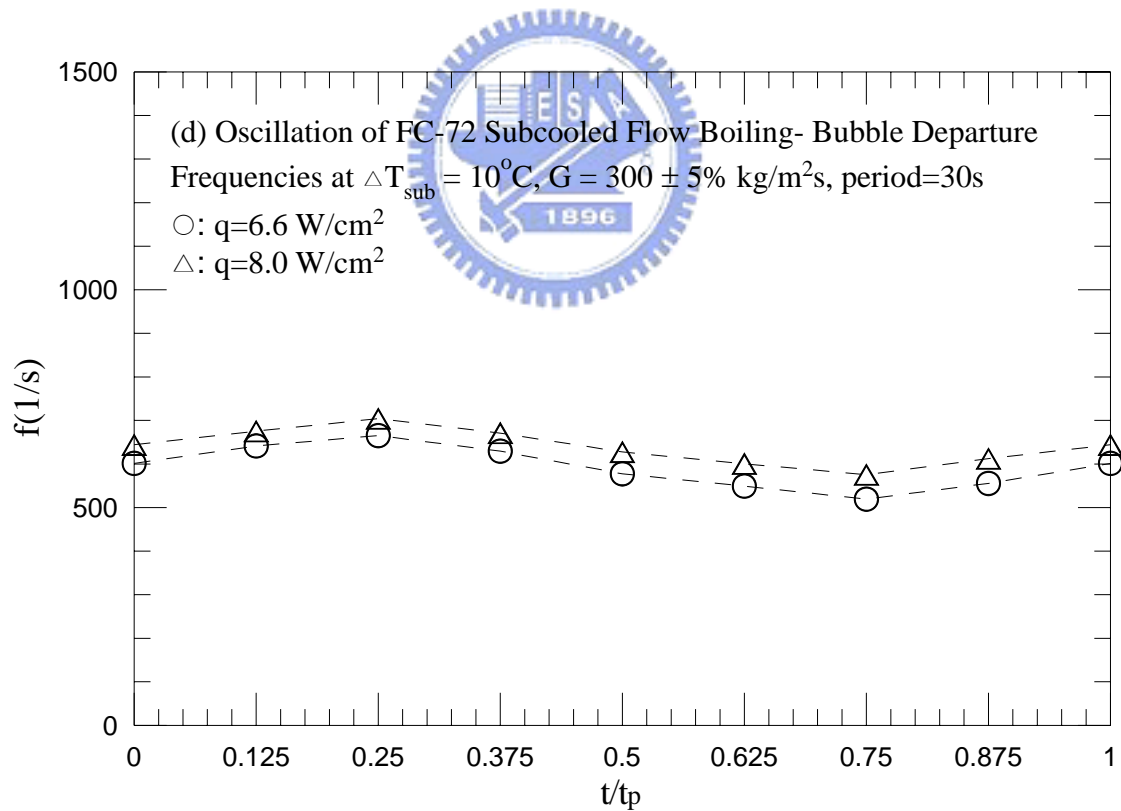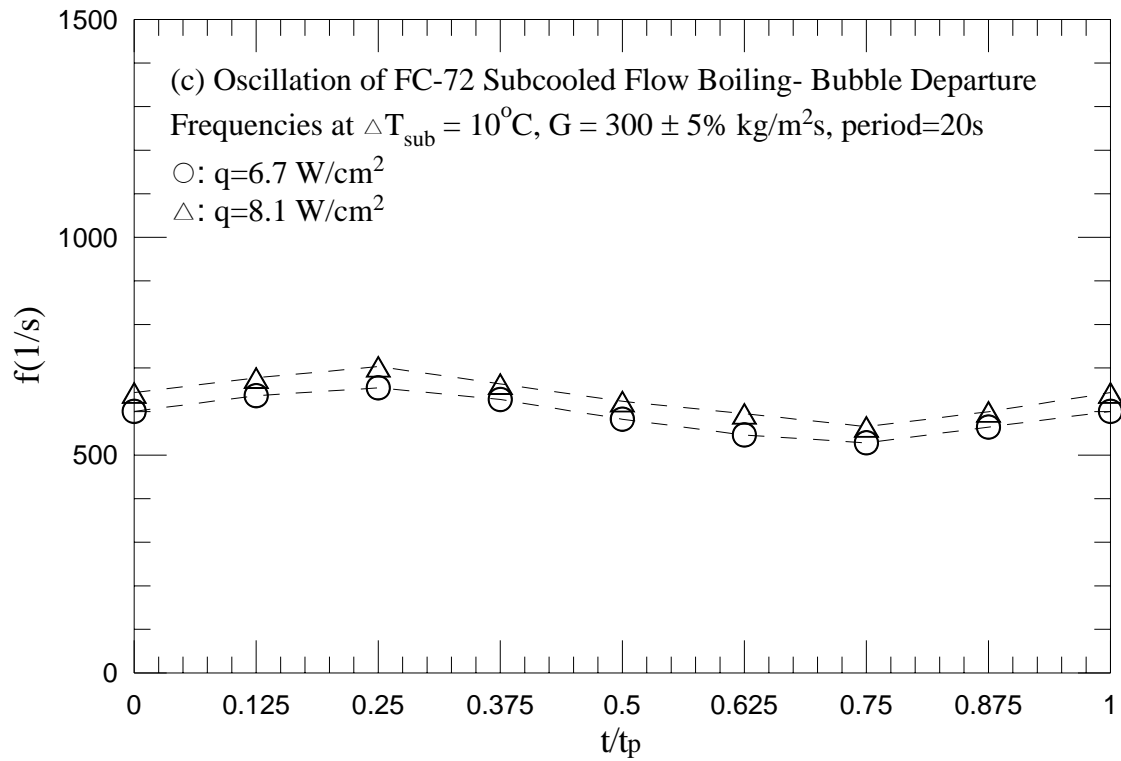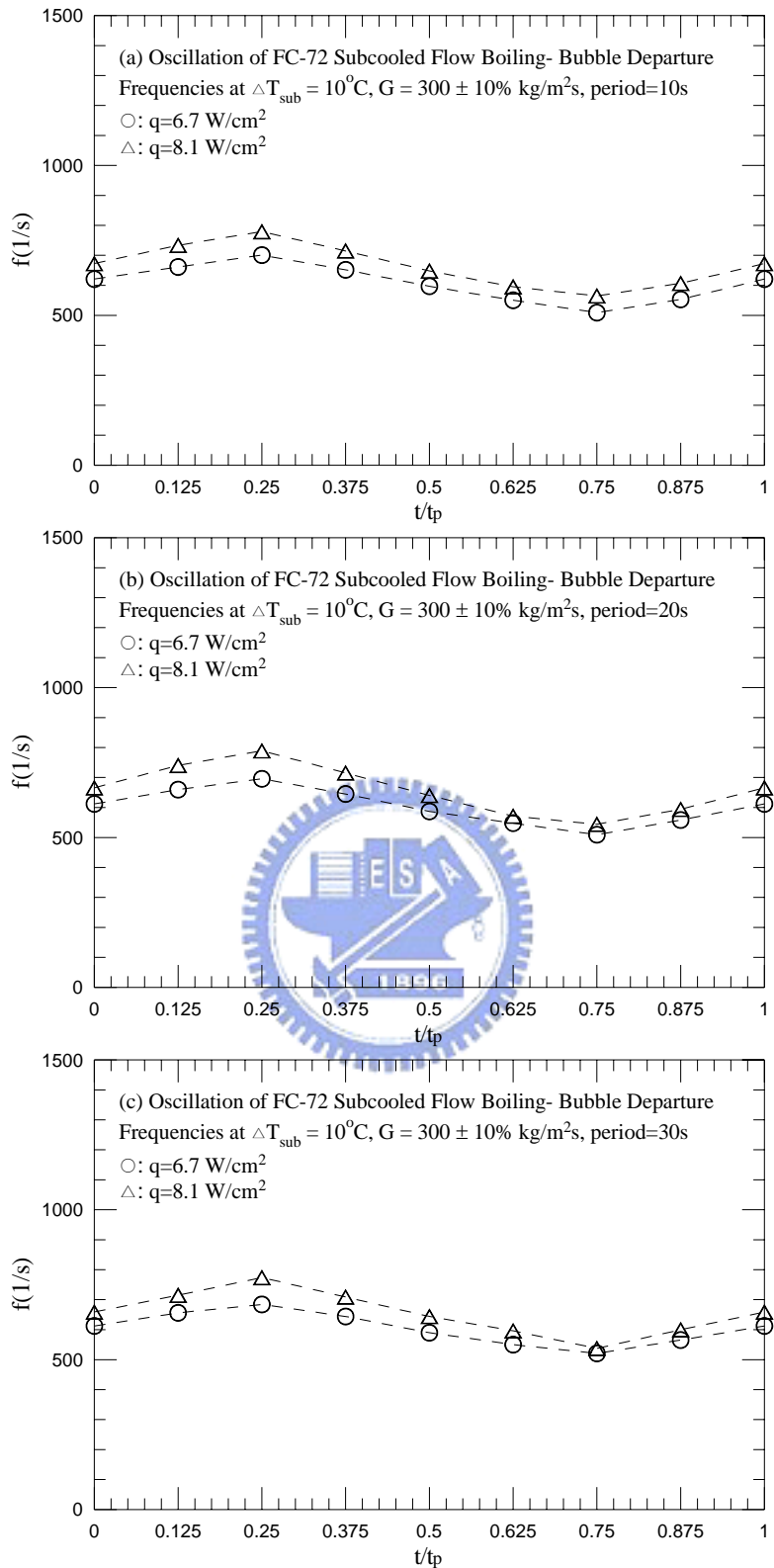○: q=6.6 W/cm²
△: q=8.0 W/cm²

Fig. 5.183 Continued.

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Fig. 5.184 Mean bubble departure frequencies for various imposed heat fluxes for transient subcooled flow boiling for G=300±10% kg/m^{2}s and ΔT_{sub} =10°C with t$_p$=10 sec (a), 20sec (b) and 30 sec (c).
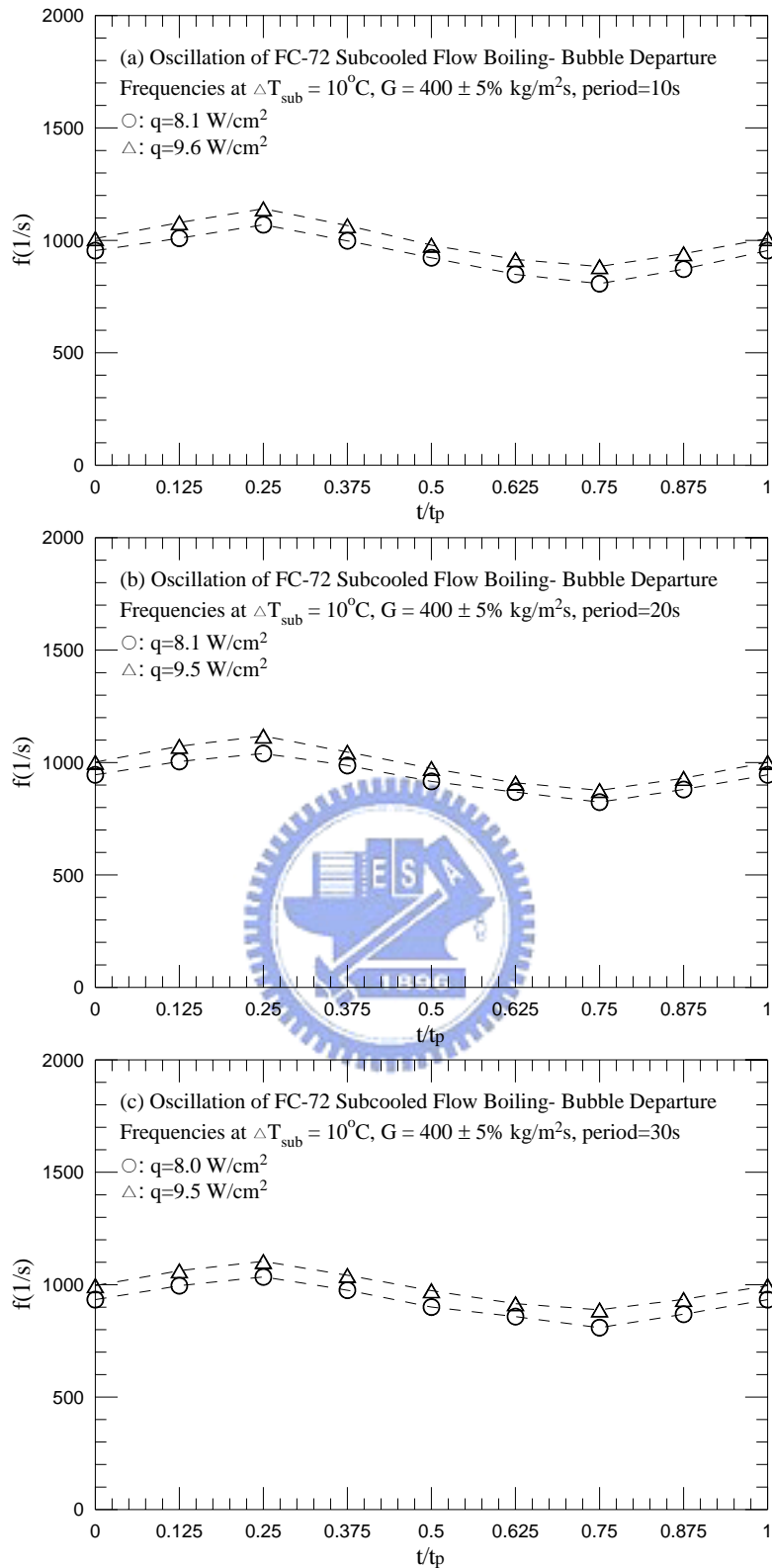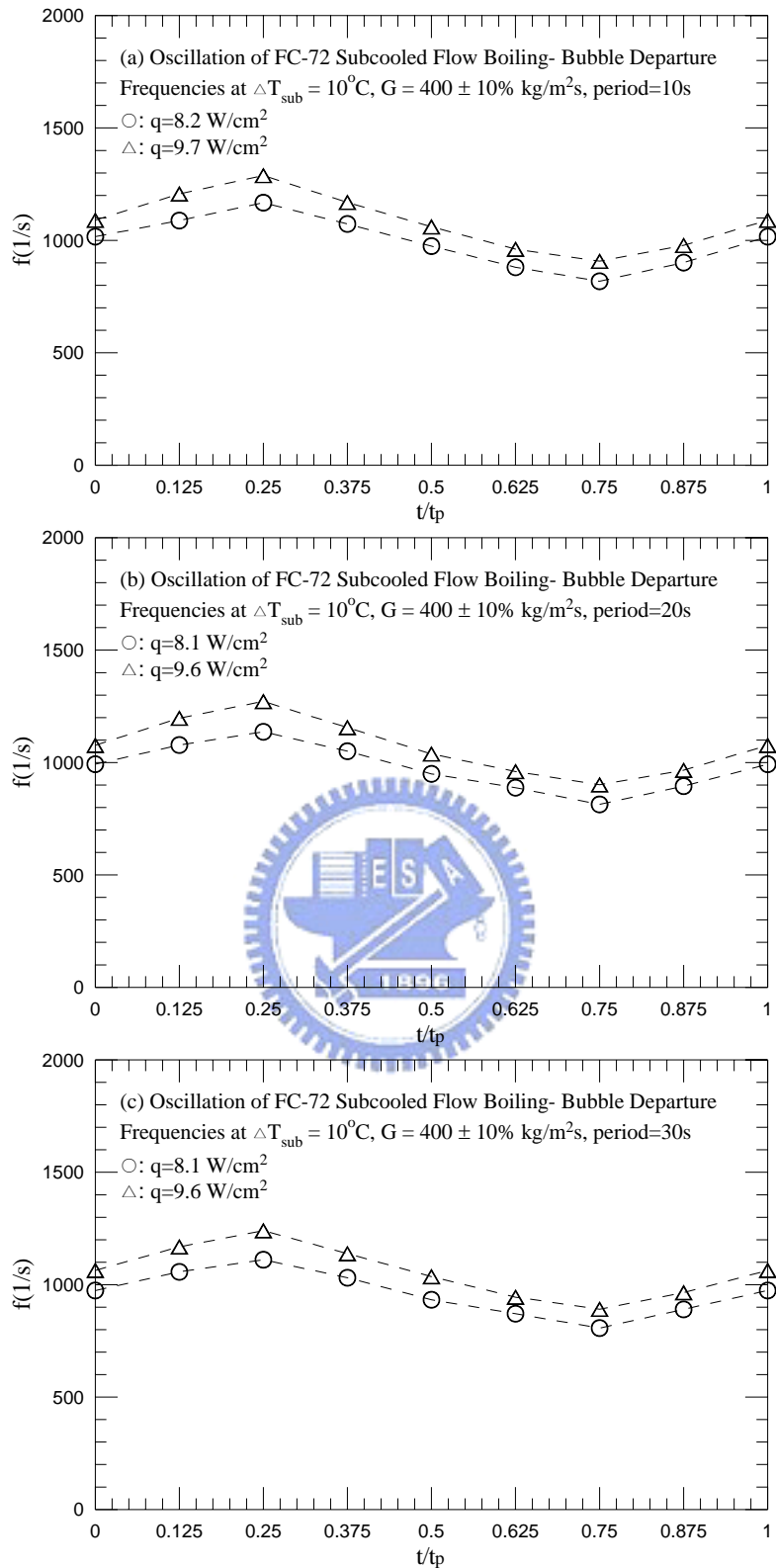
Fig. 5.185 Mean bubble departure frequencies for various imposed heat fluxes for transient subcooled flow boiling for G=400±5% kg/m²s and ΔT_{sub} =10°C with t_p=10 sec (a), 20sec (b) and 30 sec (c).

Fig. 5.186 Mean bubble departure frequencies for various imposed heat fluxes for transient subcooled flow boiling for G=400±10% kg/m²s and ΔT_{sub} =10°C with t_p=10 sec (a), 20sec (b) and 30 sec (c).
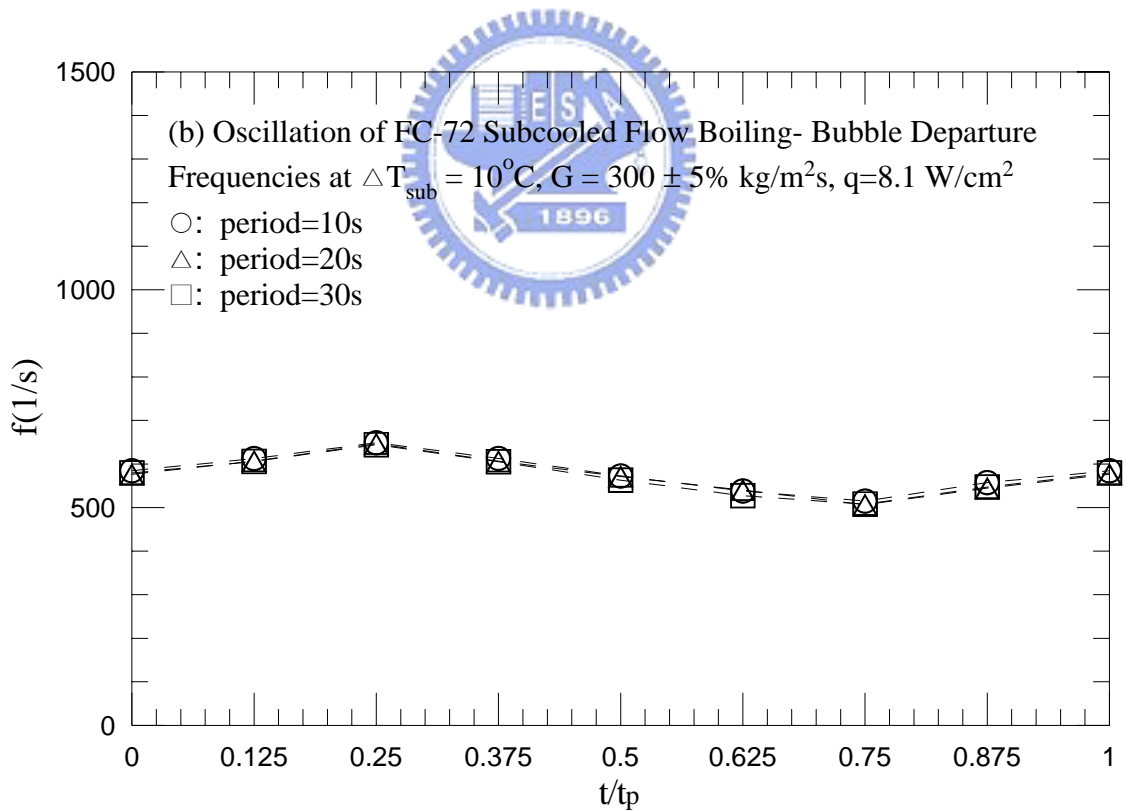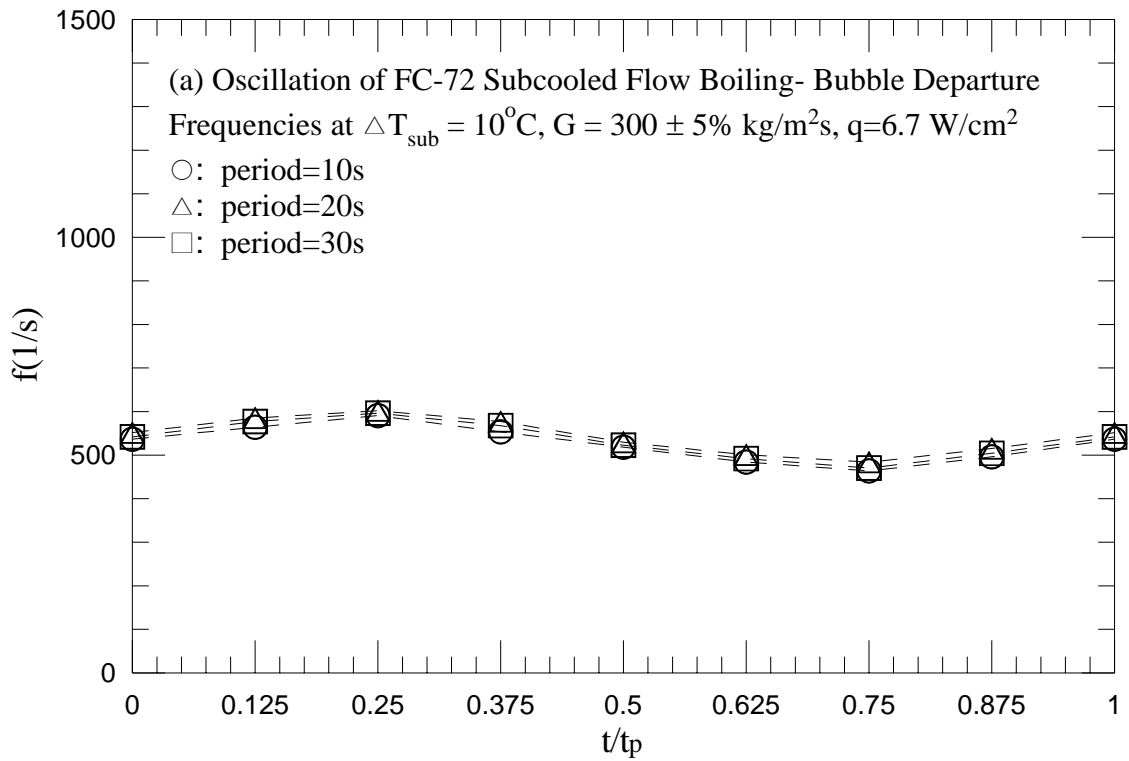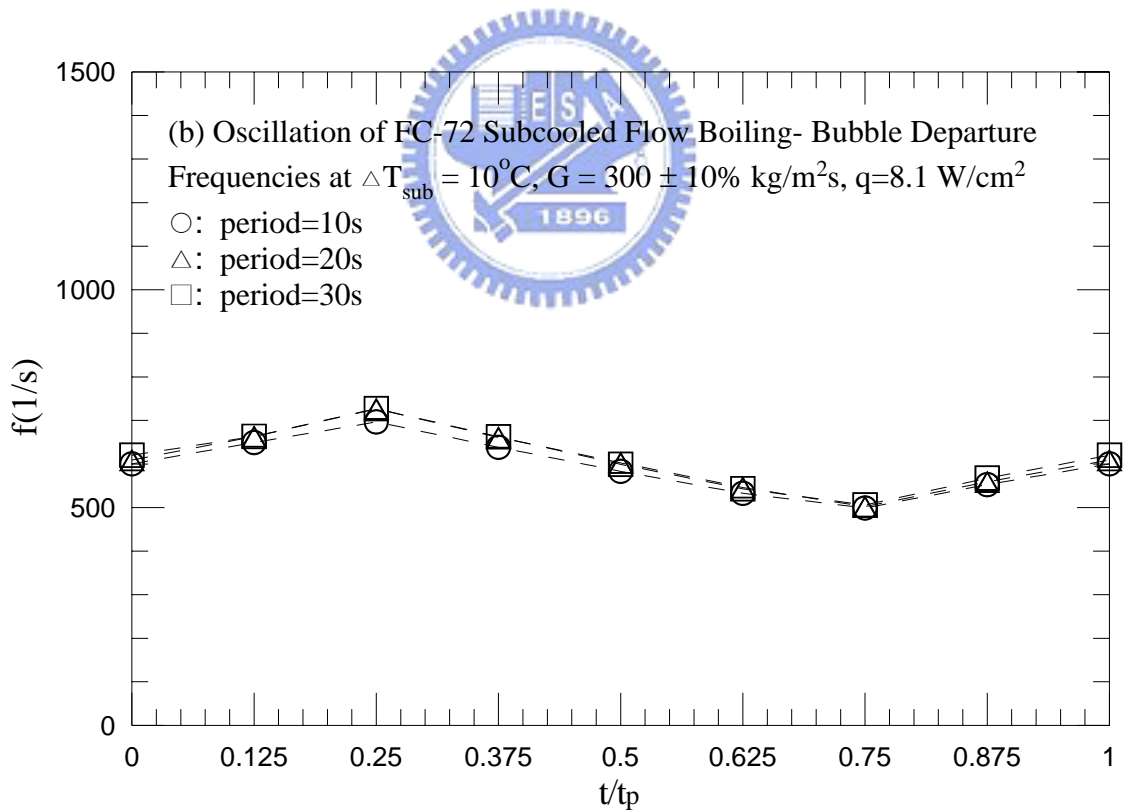
Fig. 5.187 Mean bubble departure frequencies for various periods of mass flux oscillation for transient subcooled flow boiling for G=300±5% kg/m^{2}s and ΔT_{sub} =10°C with (a) q=6.7 W/cm^2 and (b) q=8.1 W/cm^2.
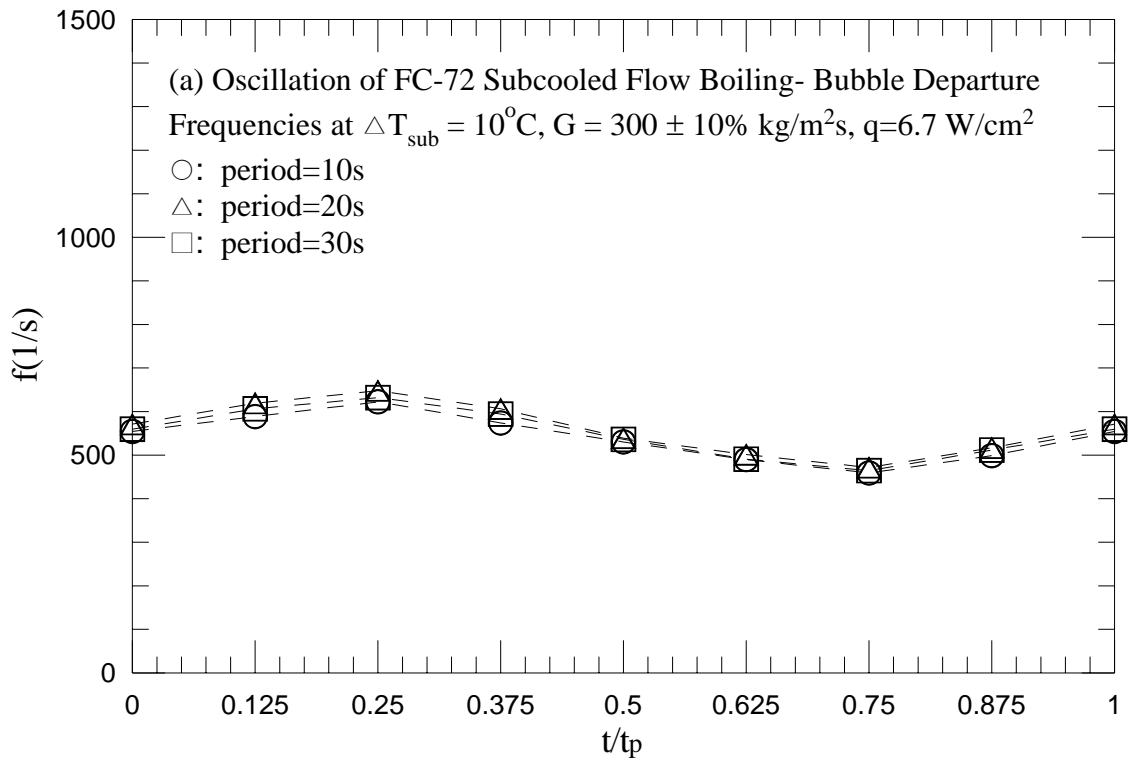
Fig. 5.188 Mean bubble departure frequencies for various periods of mass flux oscillation for transient subcooled flow boiling for G=300±10% kg/m²s and $\triangle T_{sub}$ =10°C with (a) q=6.7 W/cm² and (b) q=8.1 W/cm².
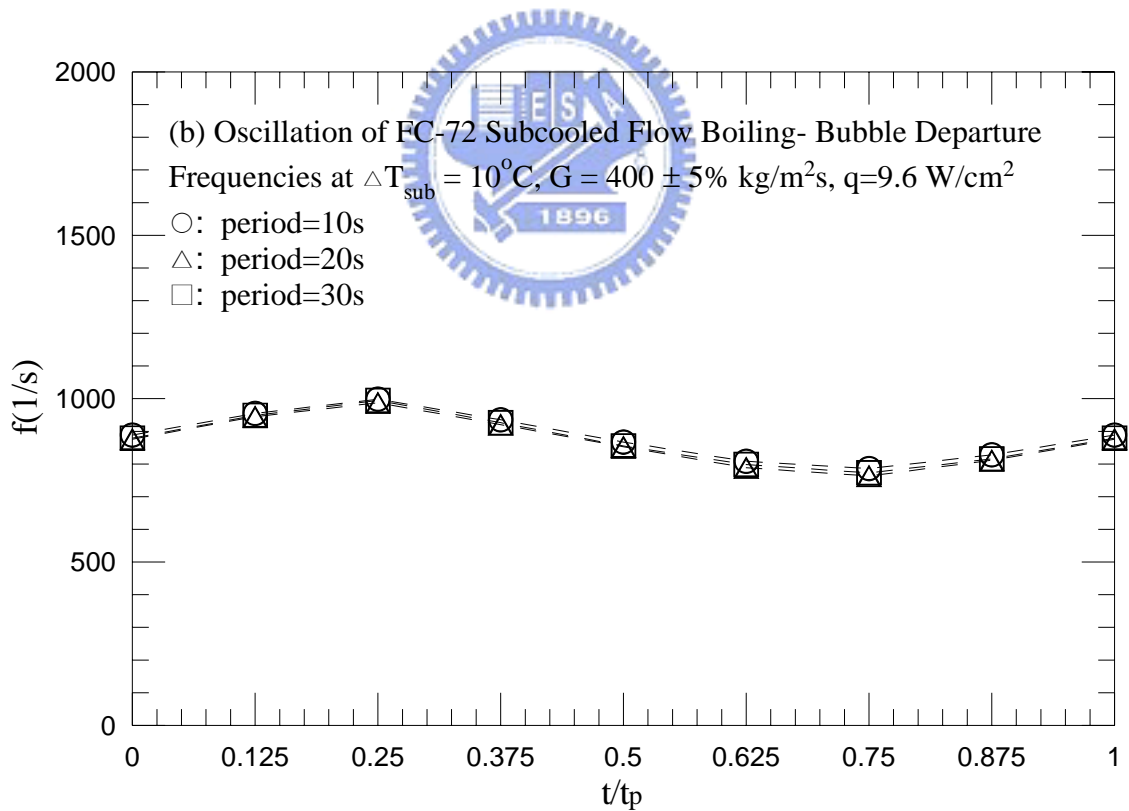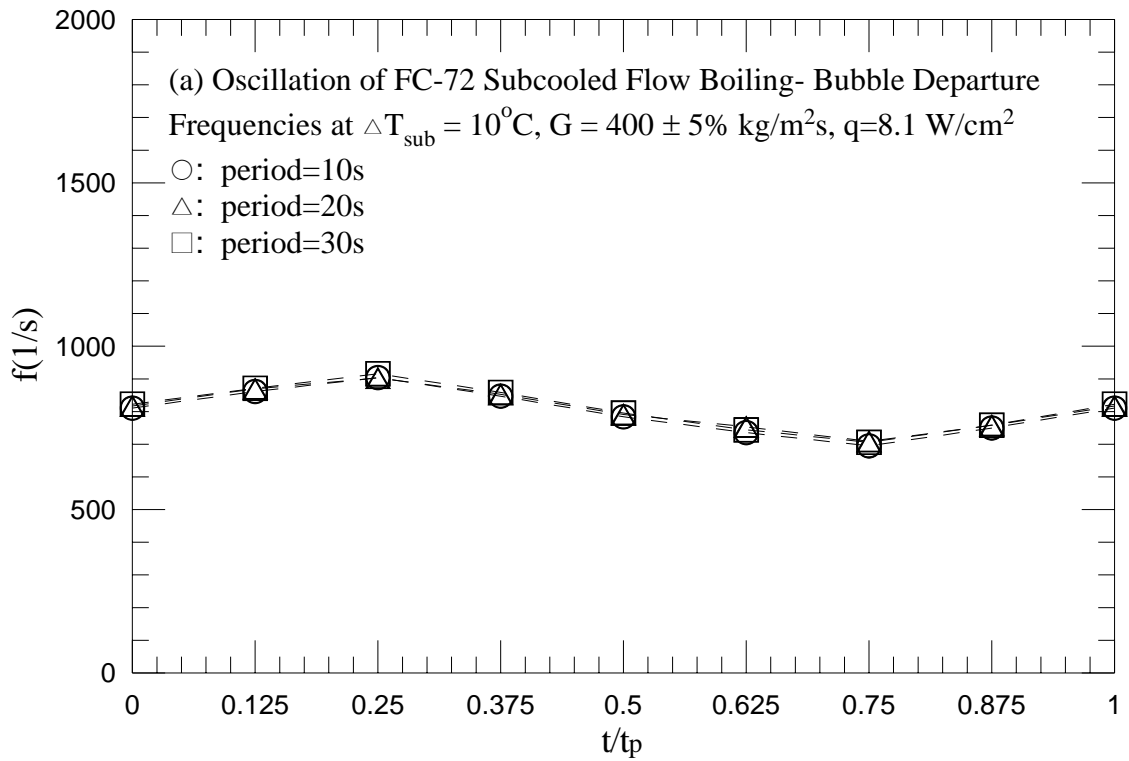
Fig. 5.189 Mean bubble departure frequencies for various periods of mass flux oscillation for transient subcooled flow boiling for G=400±5% kg/m²s and ΔT_{sub} =10°C with (a) q=8.1 W/cm² and (b) q=9.6 W/cm².
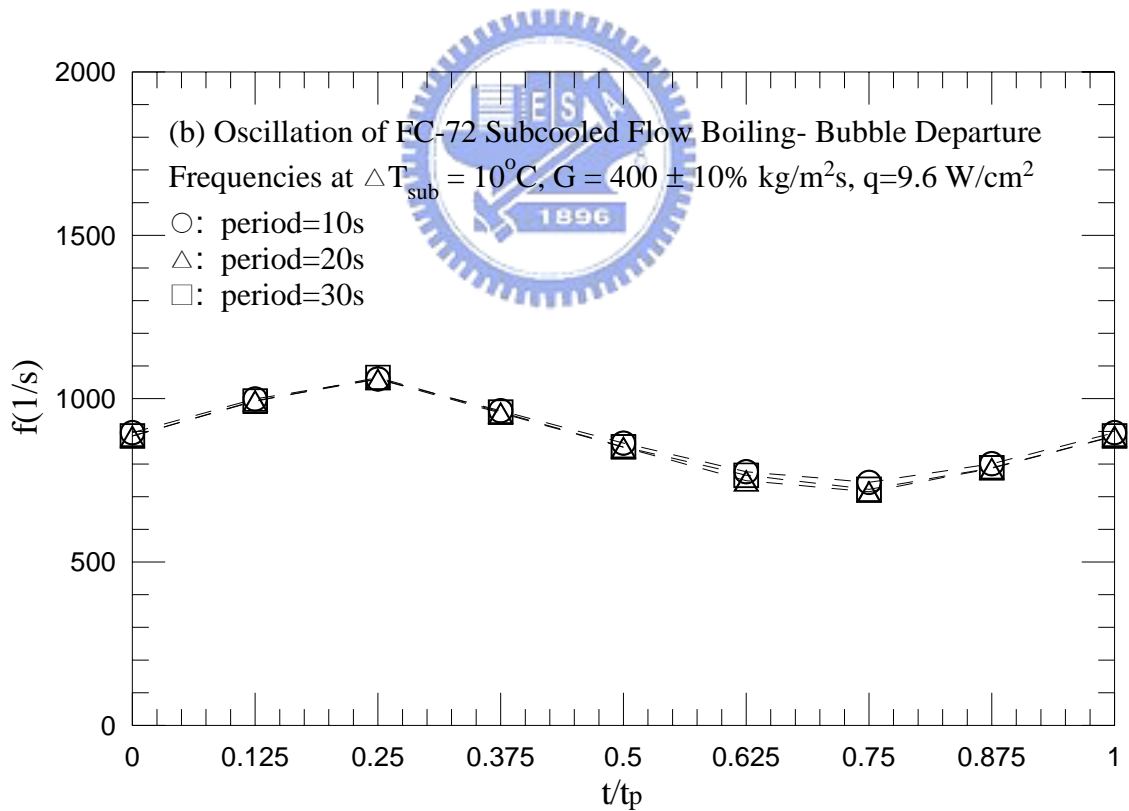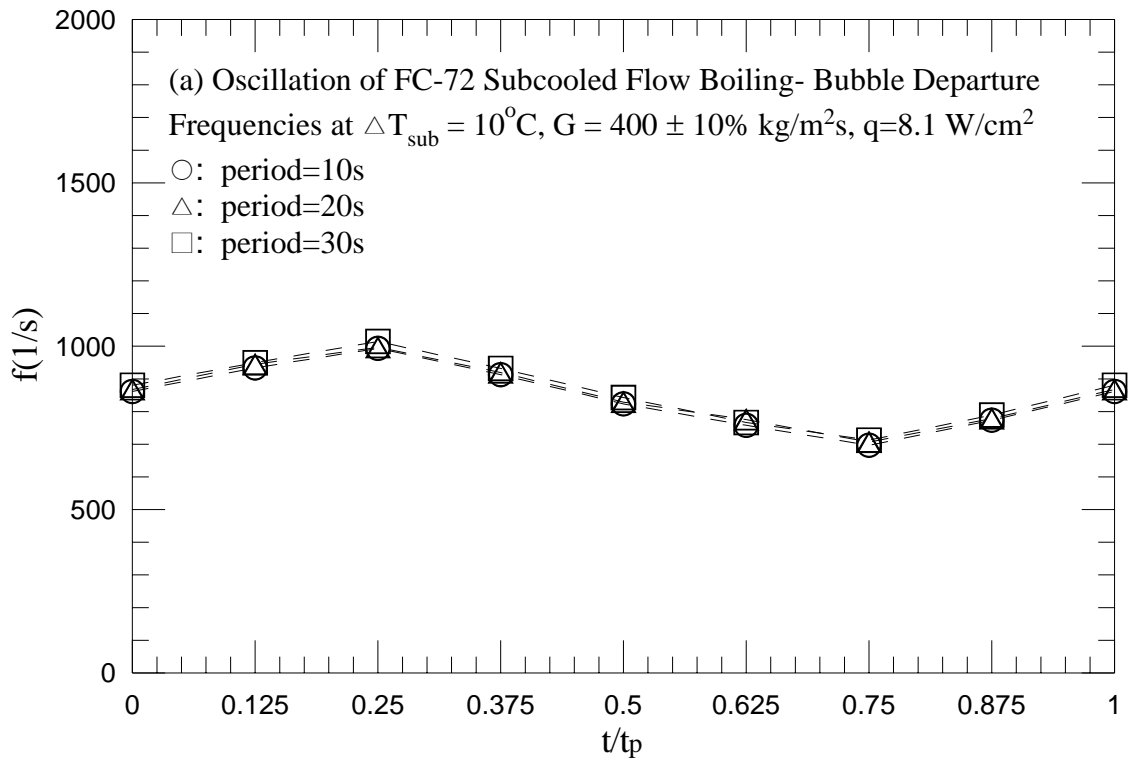
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Fig. 5.190 Mean bubble departure frequencies for various periods of mass flux oscillation for transient subcooled flow boiling for G=400±10% kg/m^{2}s and ΔT_{sub} =10°C with (a) q=8.1 W/cm^2 and (b) q=9.6 W/cm^2.
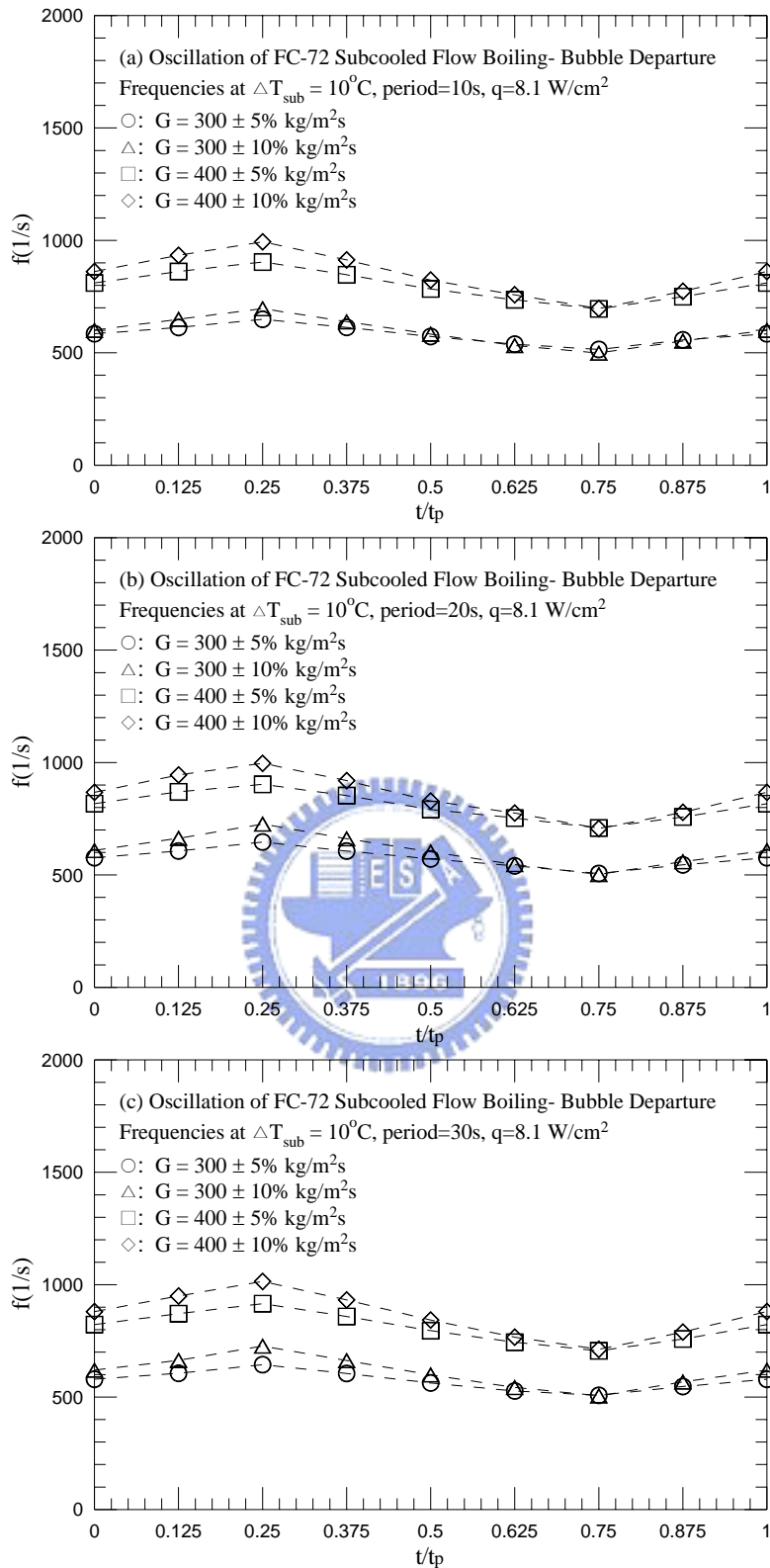
Fig. 5.191 Mean bubble departure frequencies for various amplitudes of the mass fluxes oscillation for transient subcooled flow boiling for q=8.1 W/cm^2 and ΔT_{sub} =10°C with period=10 sec (a), 20 sec (b), and 30 sec (c).
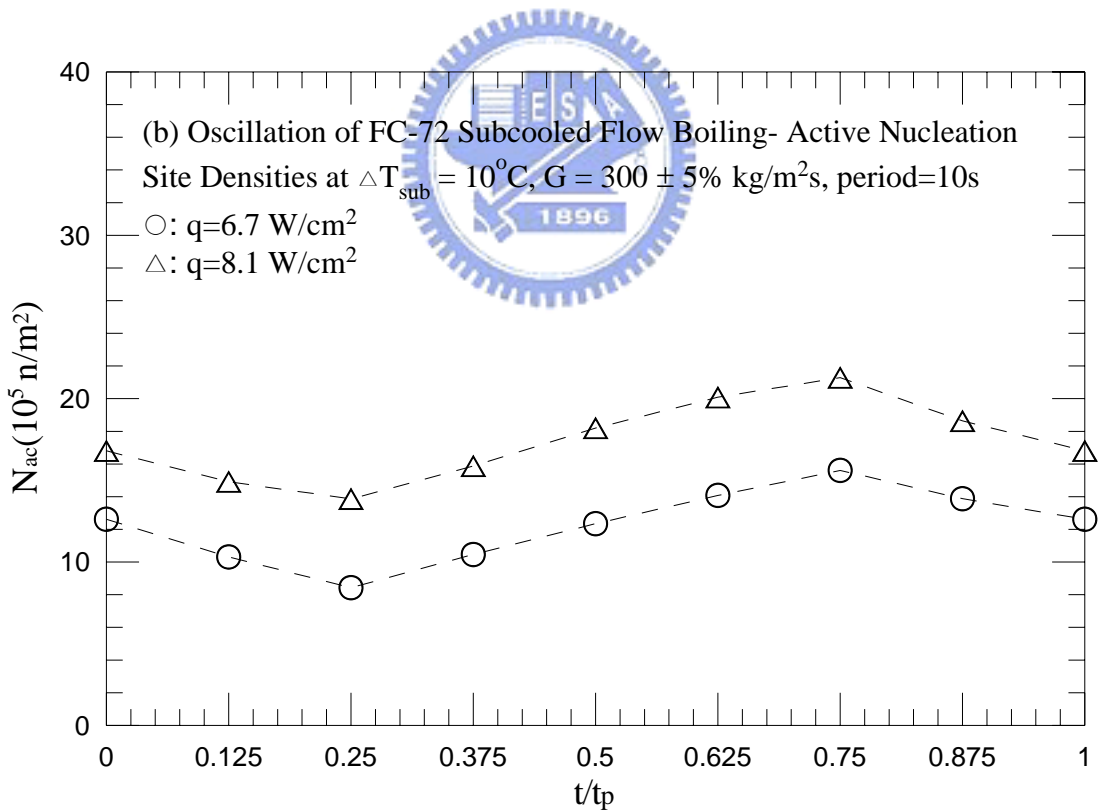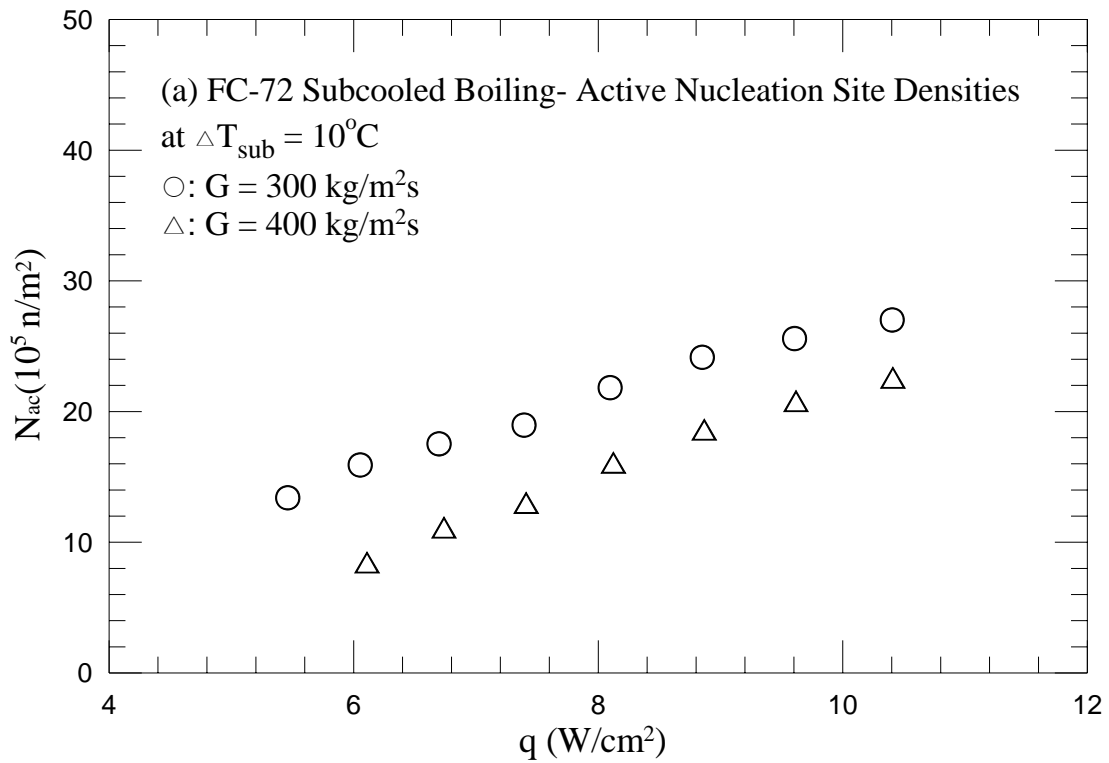
Fig. 5.192 Mean active nucleation site densities for various coolant mass fluxes for stable subcooled flow boiling (a) and various imposed heat fluxes for transient subcooled flow boiling for G=300±5% kg/m²s and $\triangle T_{sub}$ =10°C with t_p=10 sec (b), 20sec (c) and 30 sec (d).

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(c) Oscillation of FC-72 Subcooled Flow Boiling- Active Nucleation Site Densities at $\triangle T_{sub} = 10^o C$, $G = 300 \pm 5\%$ kg/m^{2}s, period=20s

○: q=6.7 W/cm^2
△: q=8.1 W/cm^2

(d) Oscillation of FC-72 Subcooled Flow Boiling- Active Nucleation Site Densities at $\triangle T_{sub} = 10^o C$, $G = 300 \pm 5\%$ kg/m^{2}s, period=30s
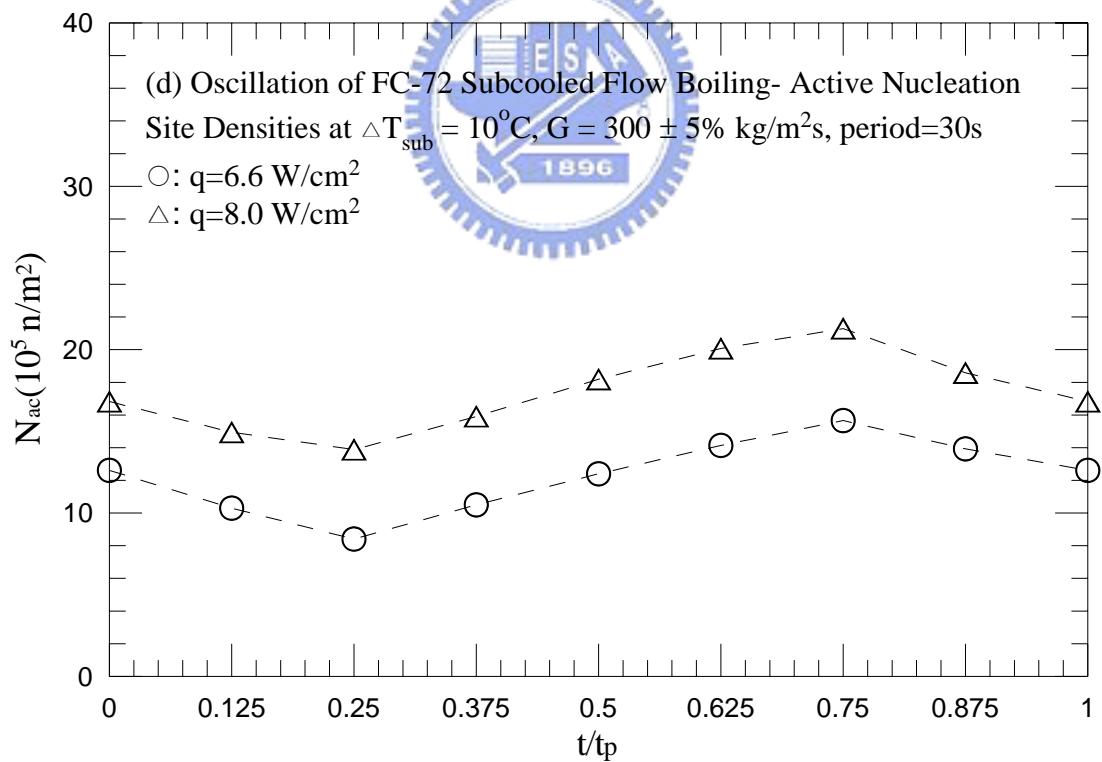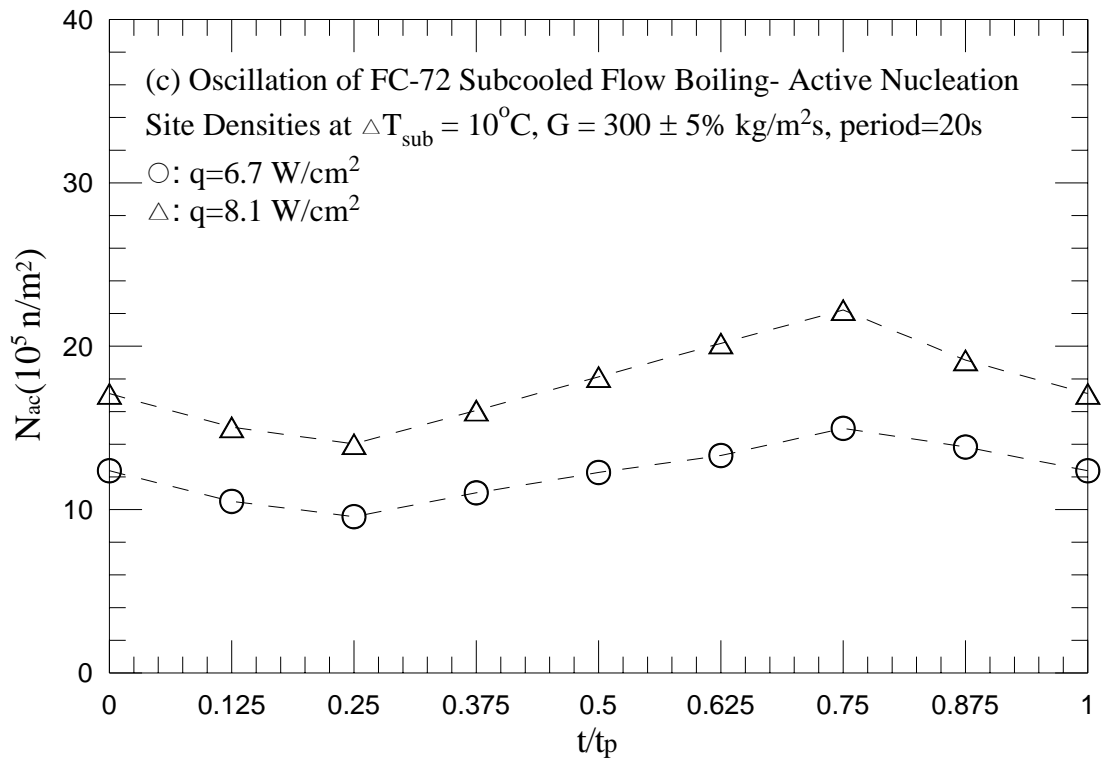
○: q=6.6 W/cm^2
△: q=8.0 W/cm^2

Fig. 5.192 Continued.
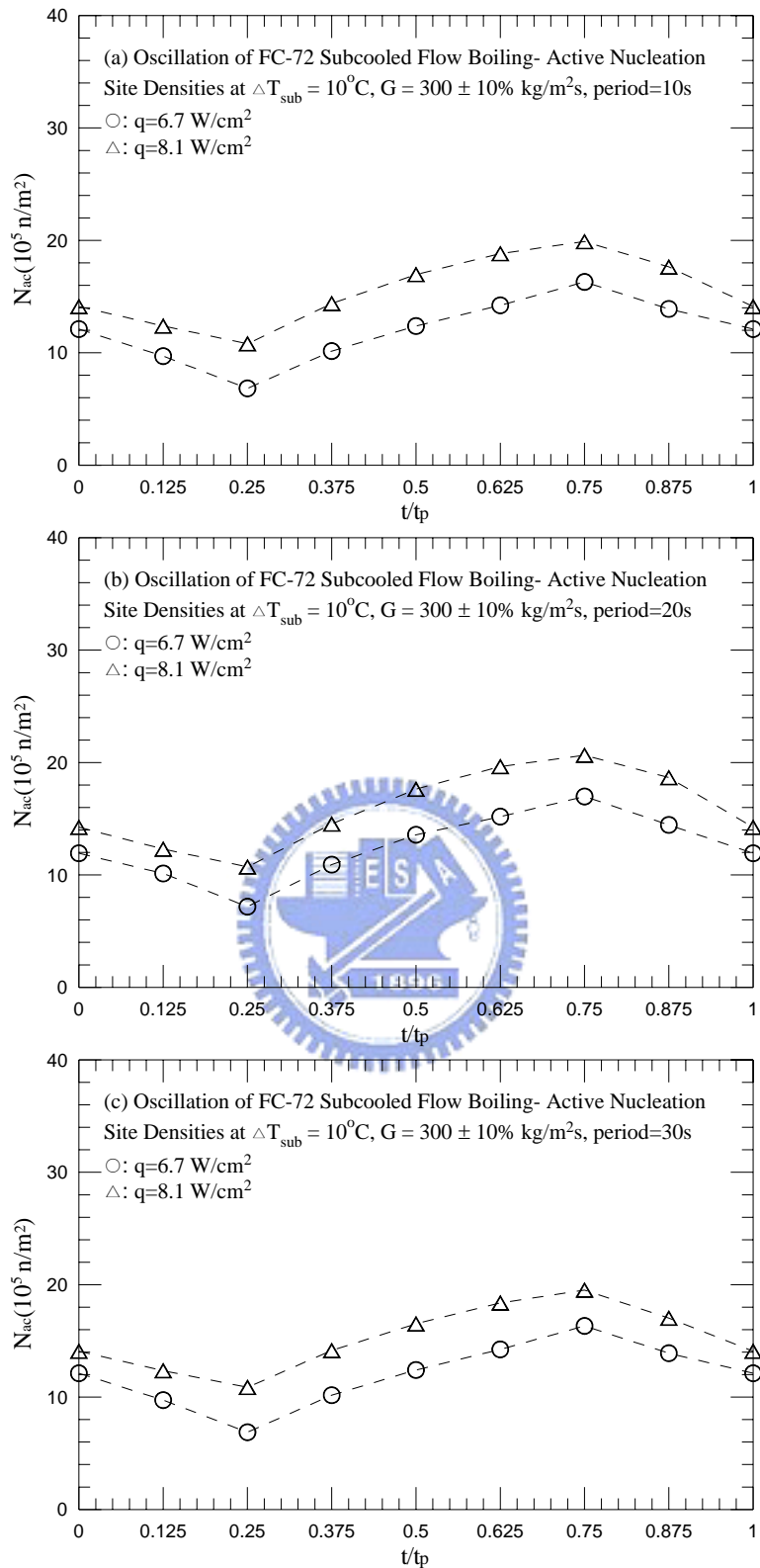
Fig. 5.193 Mean active nucleation site densities for various imposed heat fluxes for transient subcooled flow boiling for G=300±10% kg/m^{2}s and ΔT_{sub} =10°C with t$_p$=10 sec (a), 20sec (b) and 30 sec (c).
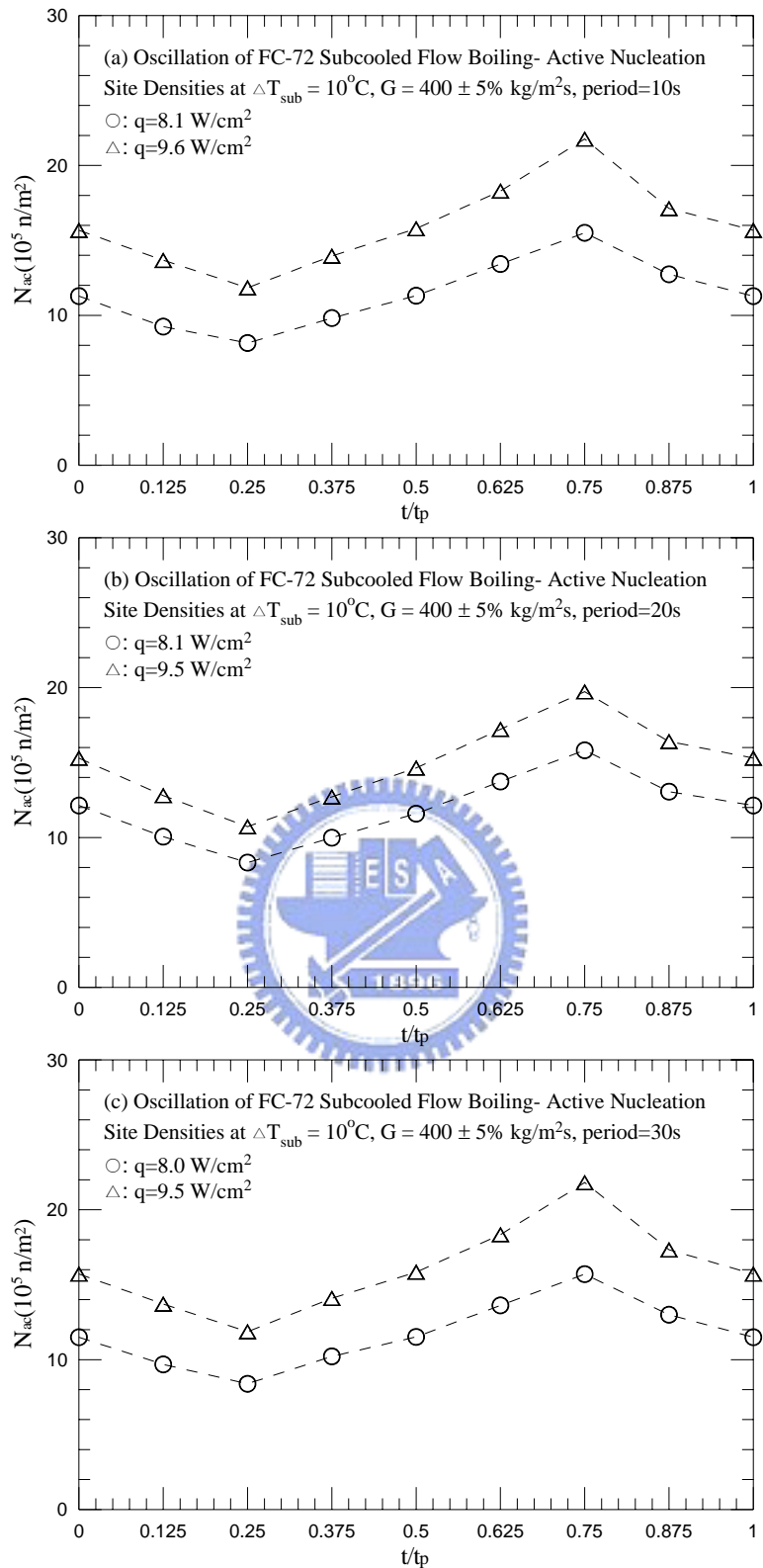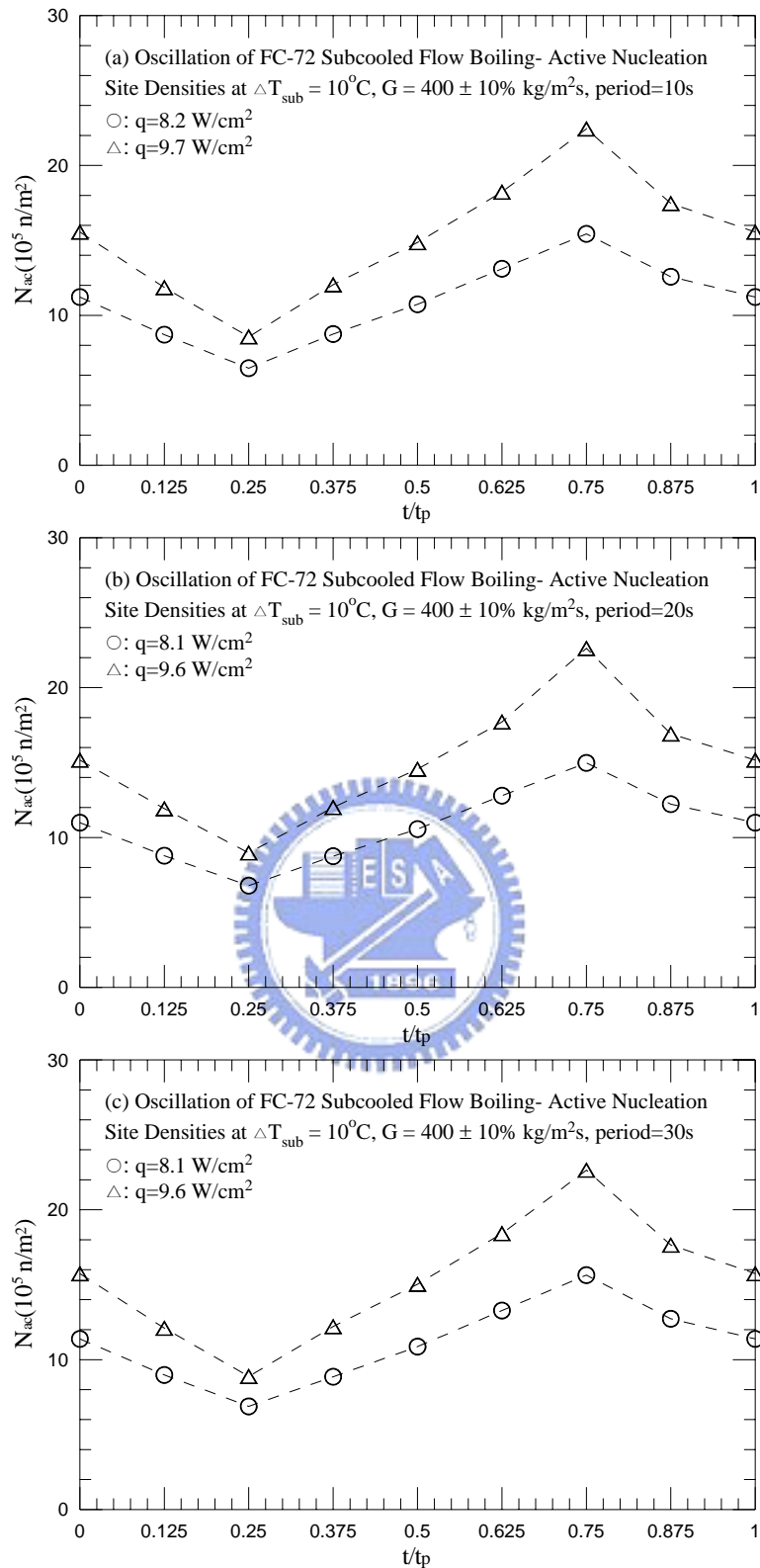
Fig. 5.194 Mean active nucleation site densities for various imposed heat fluxes for transient subcooled flow boiling for $G=400\pm5\%$ kg/m^{2}s and ΔT_{sub} =10°C with t_p=10 sec (a), 20sec (b) and 30 sec (c).

Fig. 5.195 Mean active nucleation site densities for various imposed heat fluxes for transient subcooled flow boiling for G=400±10% kg/m²s and ΔT_{sub} =10°C with t_p=10 sec (a), 20sec (b) and 30 sec (c).
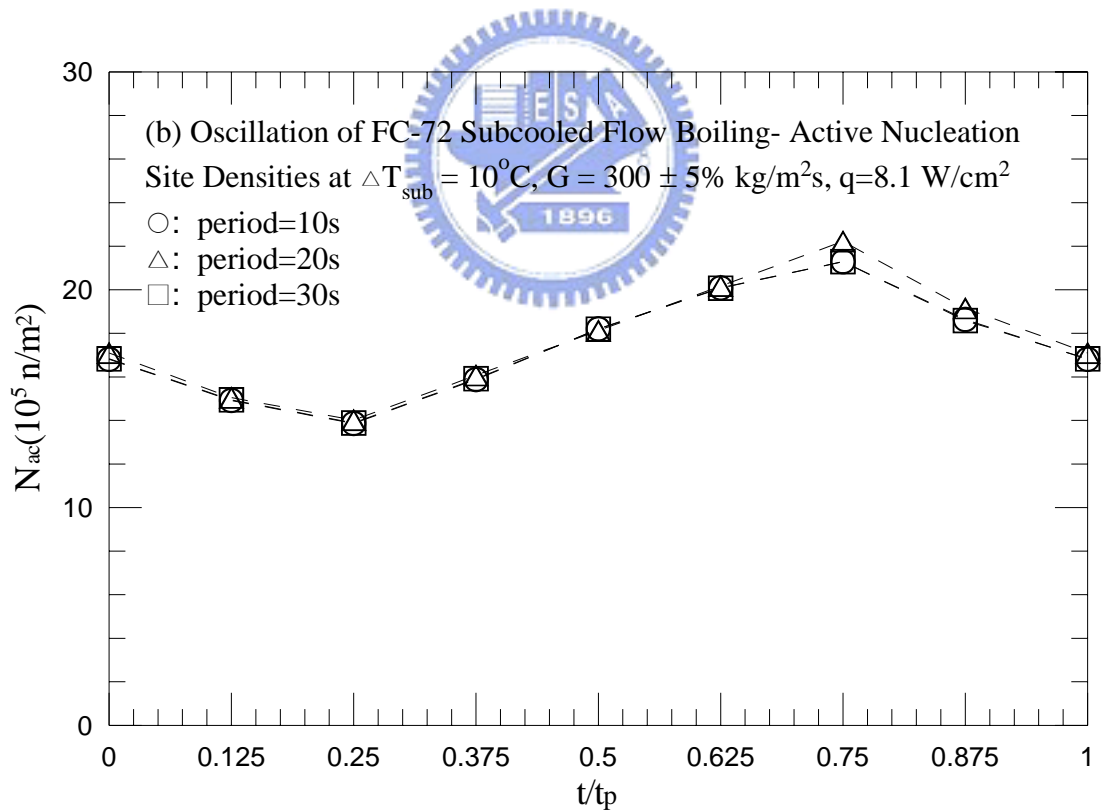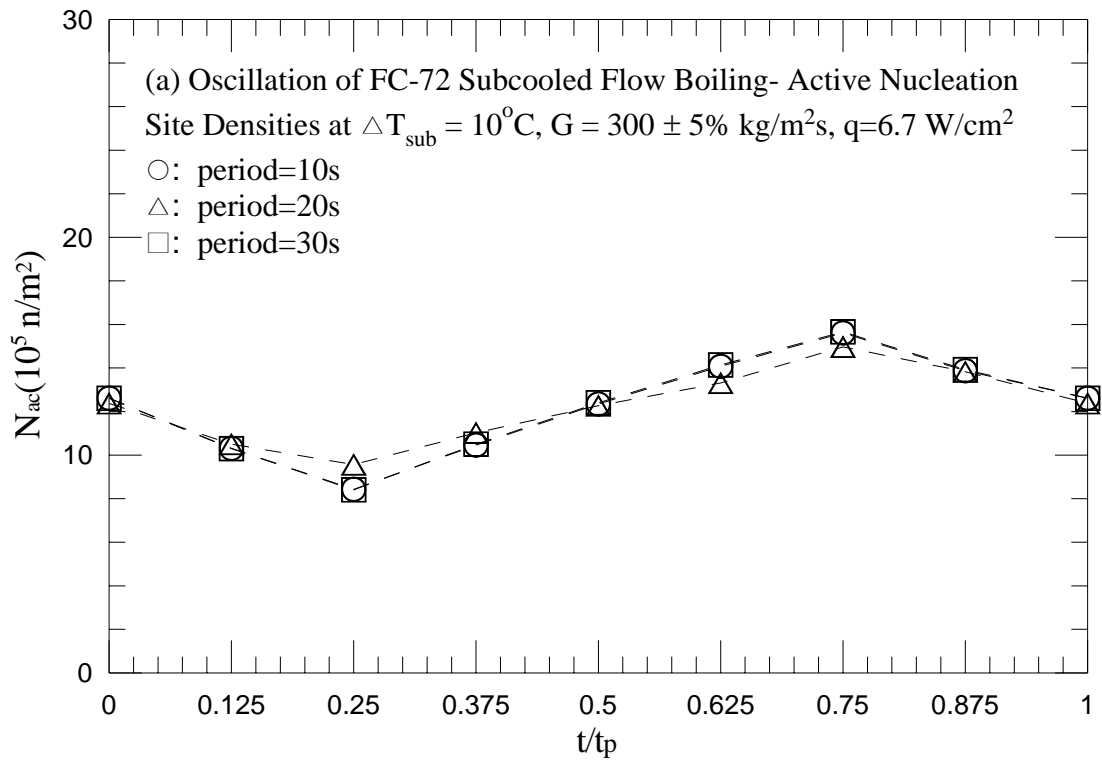
Fig. 5.196 Mean active nucleation site densities for various periods of mass flux oscillation for transient subcooled flow boiling for G=300±5% kg/m²s and $\triangle T_{sub}$ =10°C with (a) q=6.7 W/cm² and (b) q=8.1 W/cm².
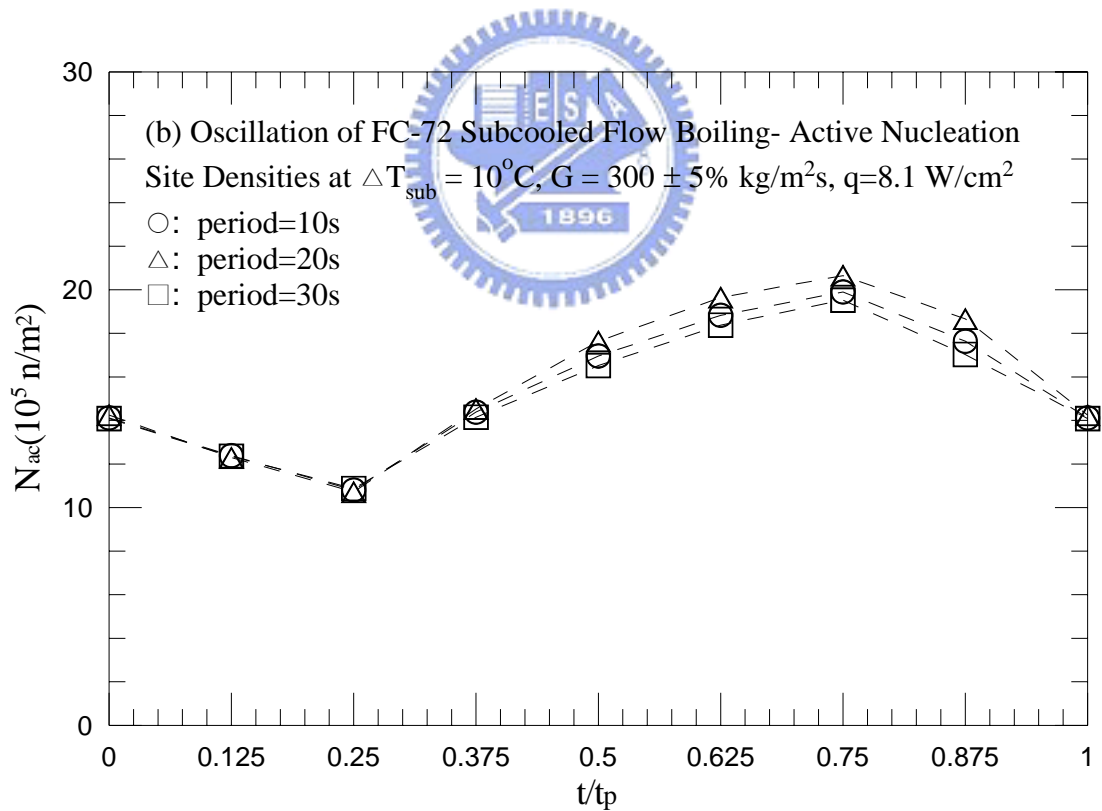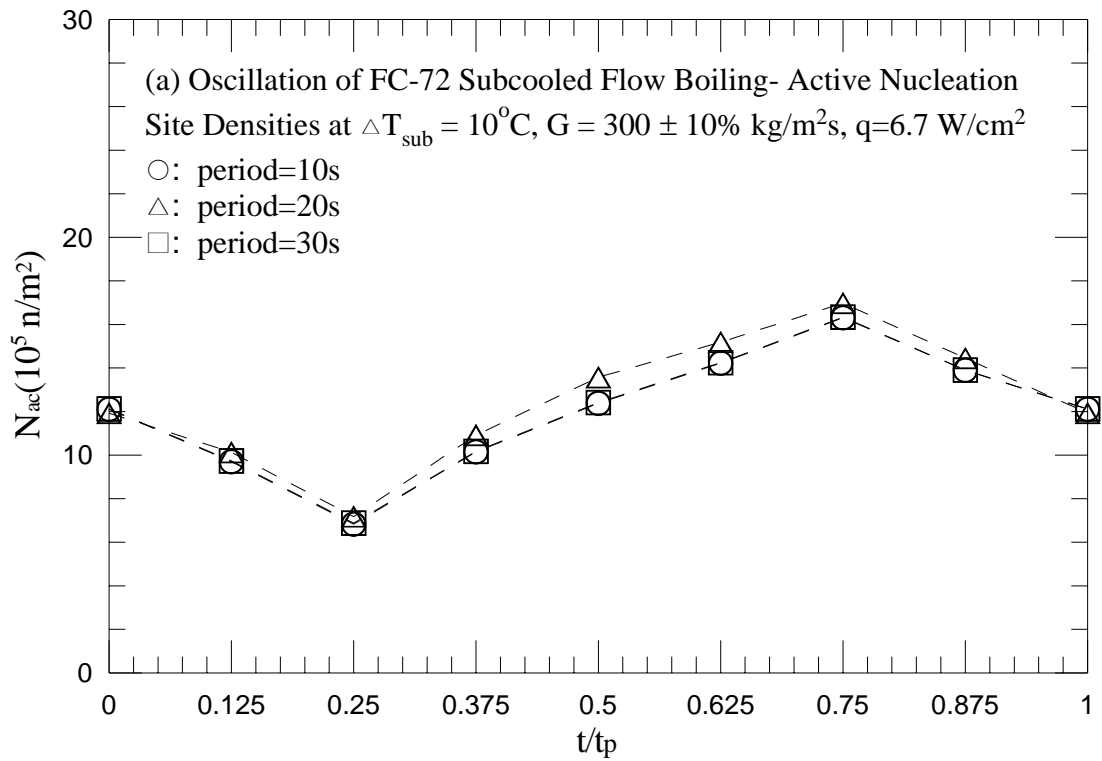
Fig. 5.197 Mean active nucleation site densities for various periods of mass flux oscillation for transient subcooled flow boiling for G=300±10% kg/m²s and $\triangle T_{sub}$ =10°C with (a) q=6.7 W/cm² and (b) q=8.1 W/cm².

Fig. 5.198 Mean active nucleation site densities for various periods of mass flux oscillation for transient subcooled flow boiling for G=400±5% kg/m^{2}s and $\triangle T_{sub}$ =10°C with (a) q=8.1 W/cm^2 and (b) q=9.6 W/cm^2.
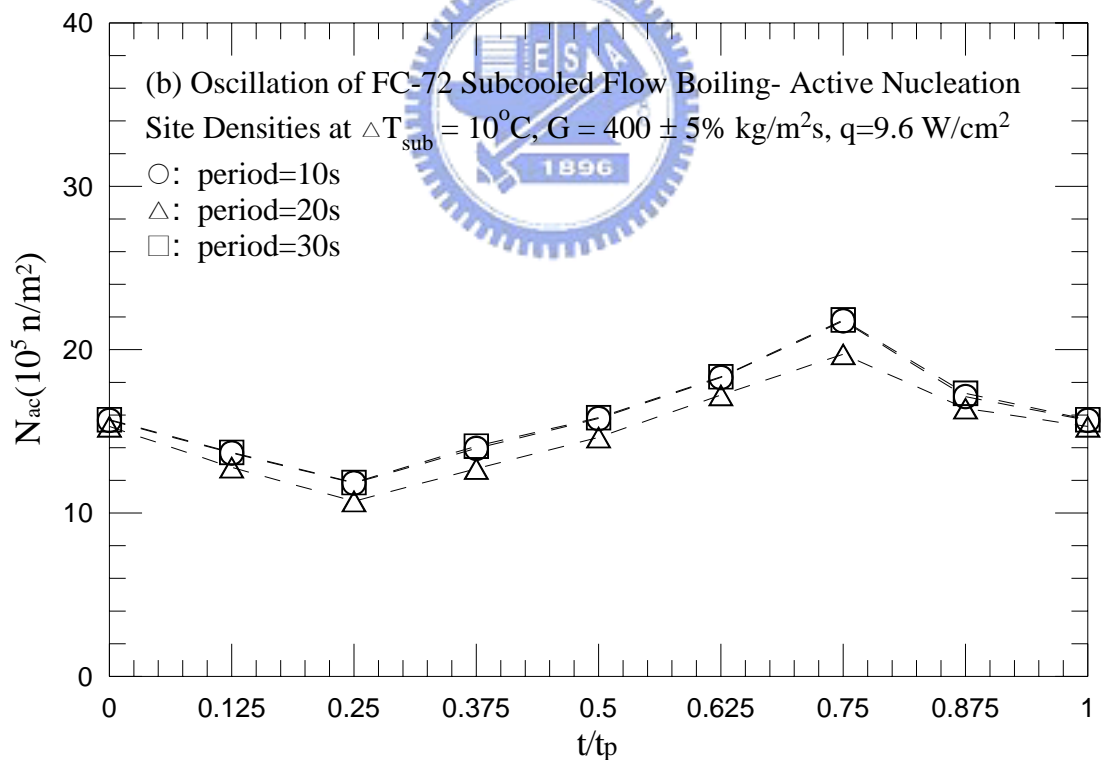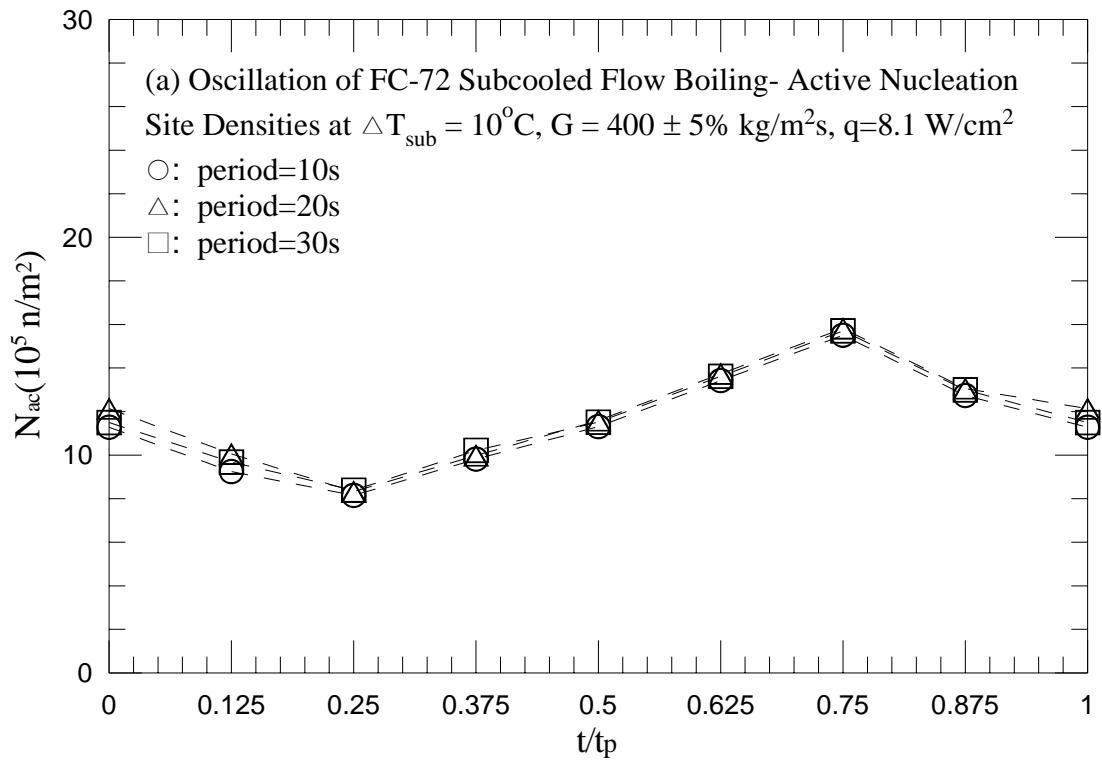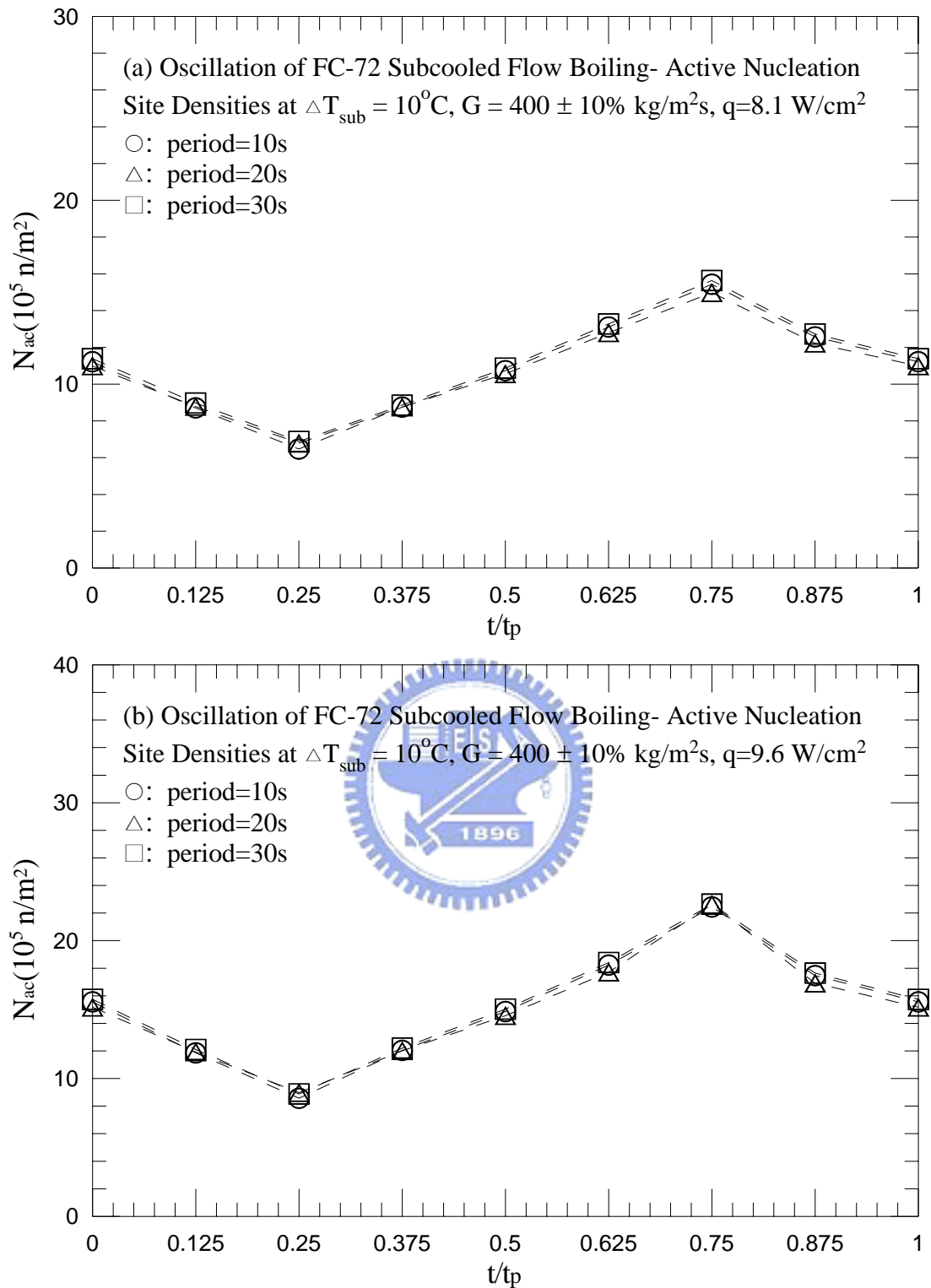
Fig. 5.199 Mean active nucleation site densities for various periods of mass flux oscillation for transient subcooled flow boiling for $G=400\pm10\%$ kg/m^{2}s and ΔT_{sub} =10°C with (a) q=8.1 W/cm^2 and (b) q=9.6 W/cm^2.
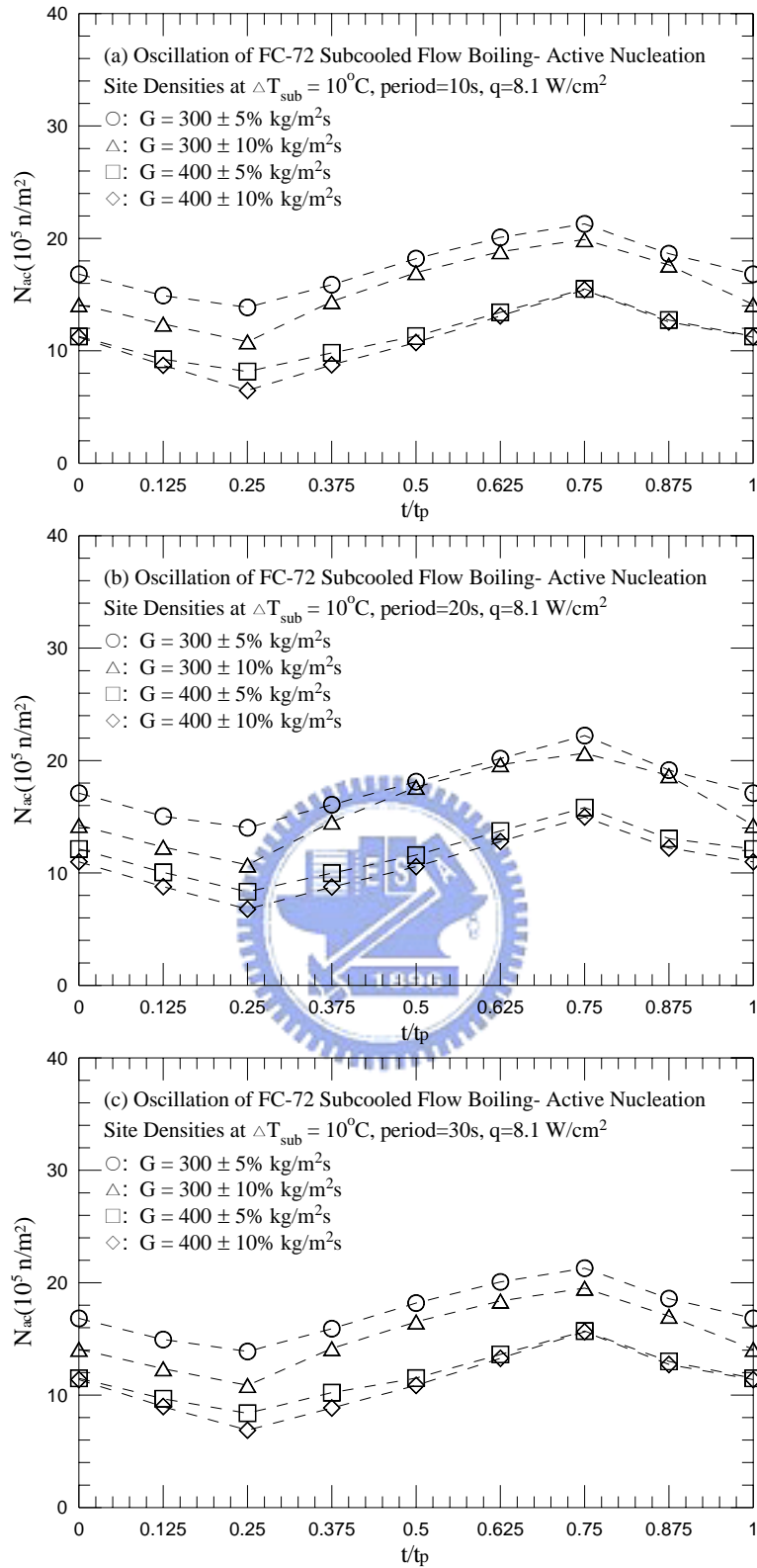
Fig. 5.200 Mean active nucleation site densities for various amplitudes of the mass fluxes oscillation for transient subcooled flow boiling for q=8.1 W/cm^2 and ΔT_{sub} =10°C with period=10 sec (a), 20 sec (b), and 30 sec (c).
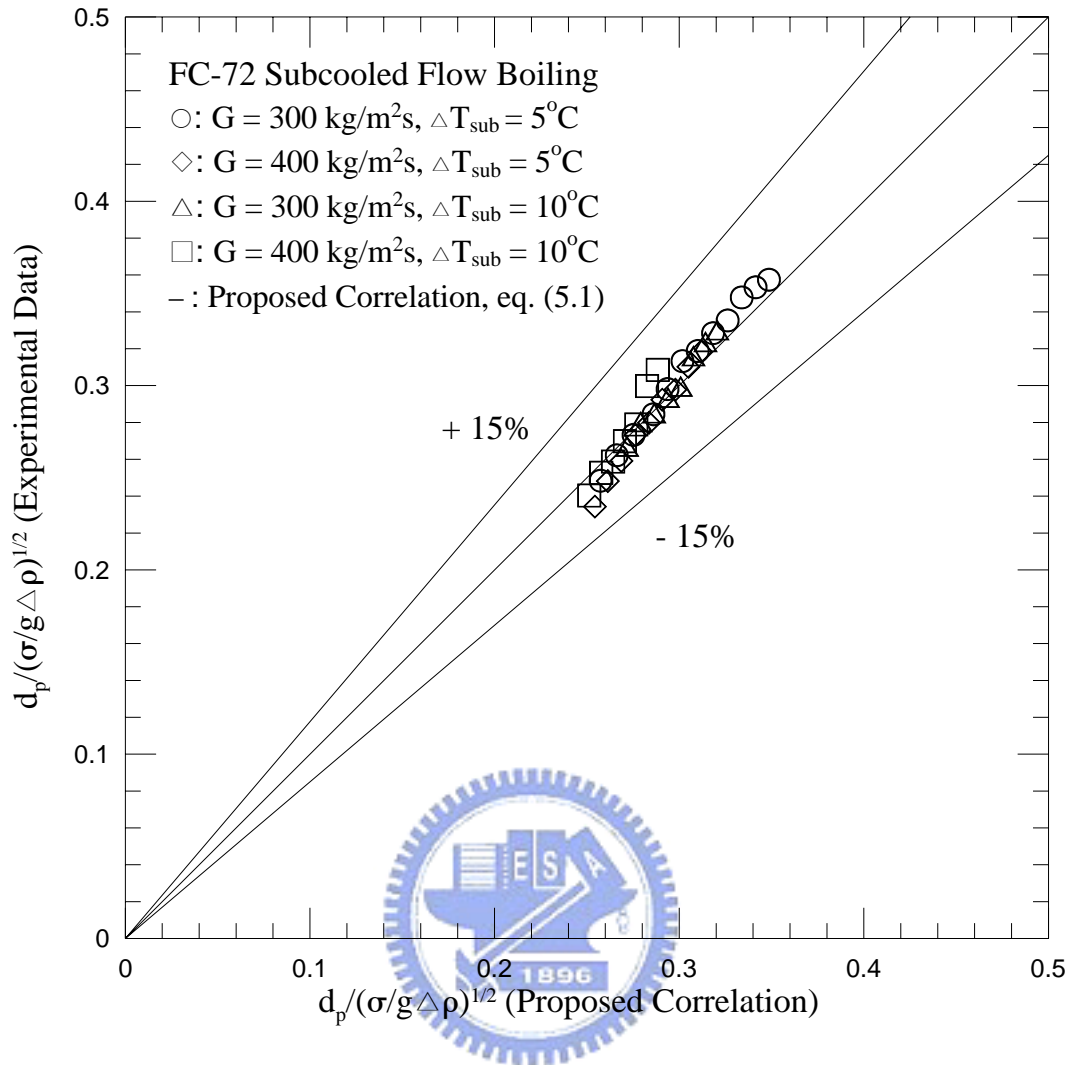
Fig. 5.201 Comparison of the measured data for mean bubble departure diameter for subcooled flow boiling of FC-72 with the proposed correlation.
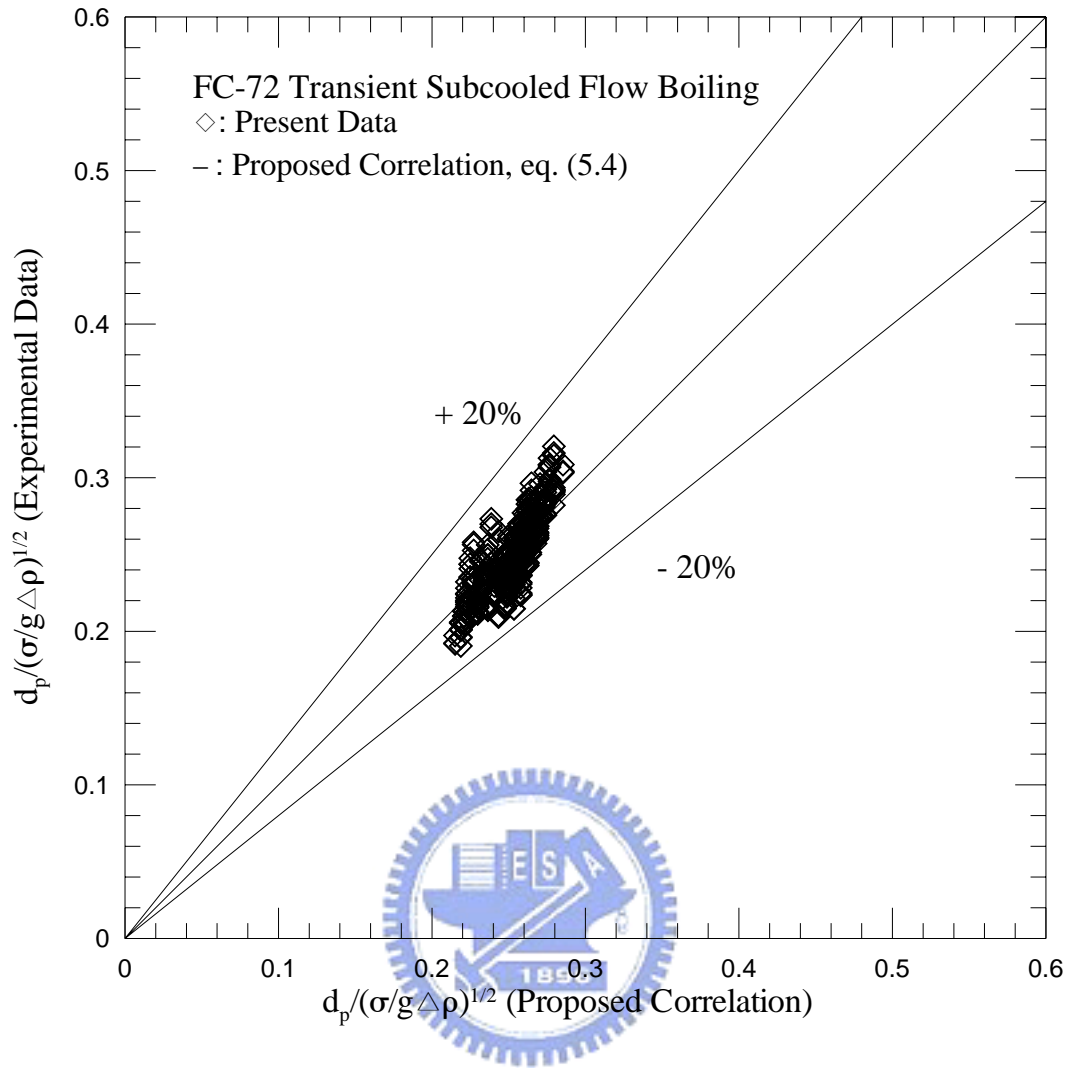
Fig. 5.202 Comparison of the measured data for mean bubble departure diameter for transient subcooled flow boiling of FC-72 with the proposed correlation.
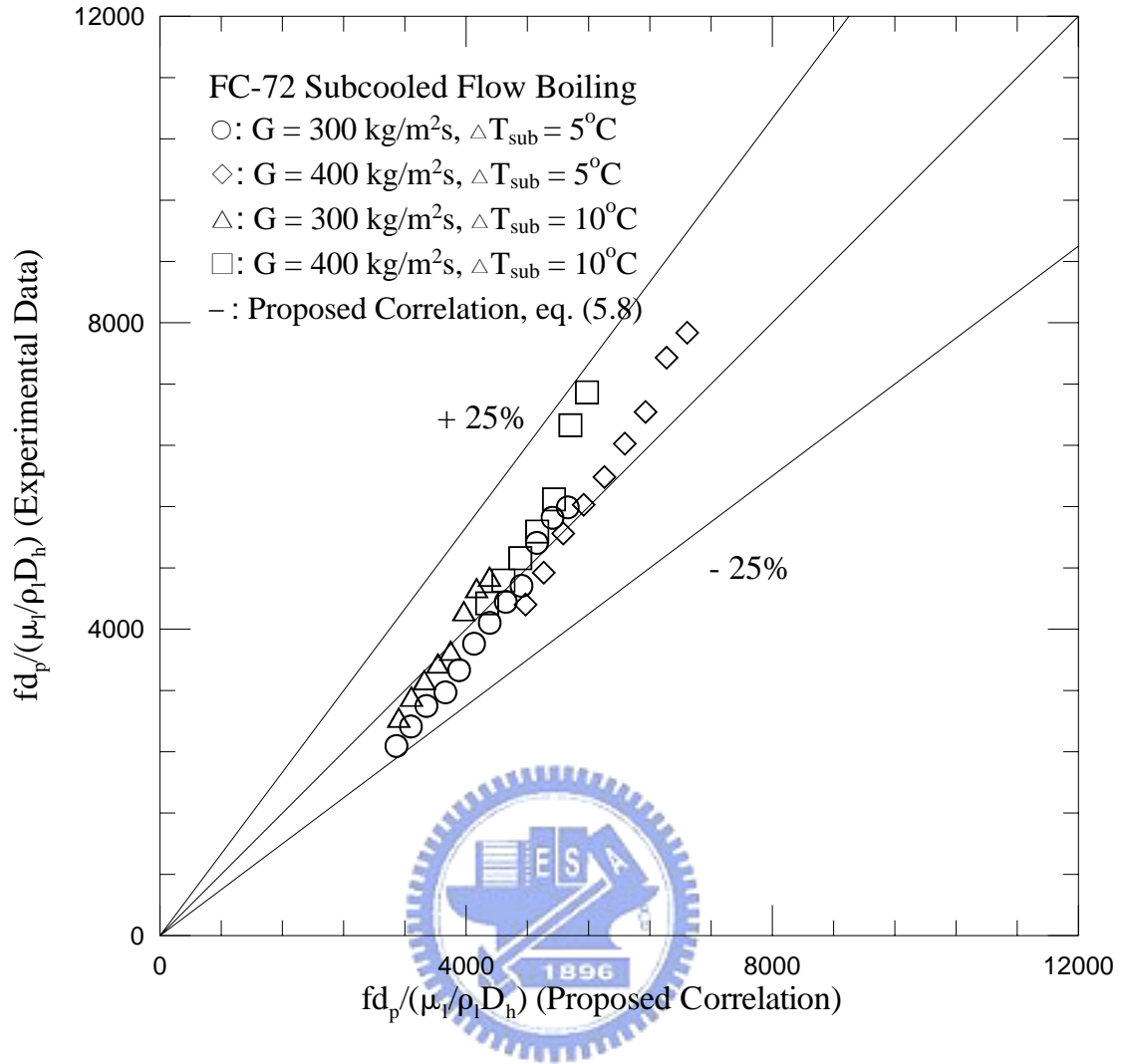
Fig. 5.203 Comparison of the measured data for mean bubble departure frequency for subcooled flow boiling of FC-72 with the proposed correlation.
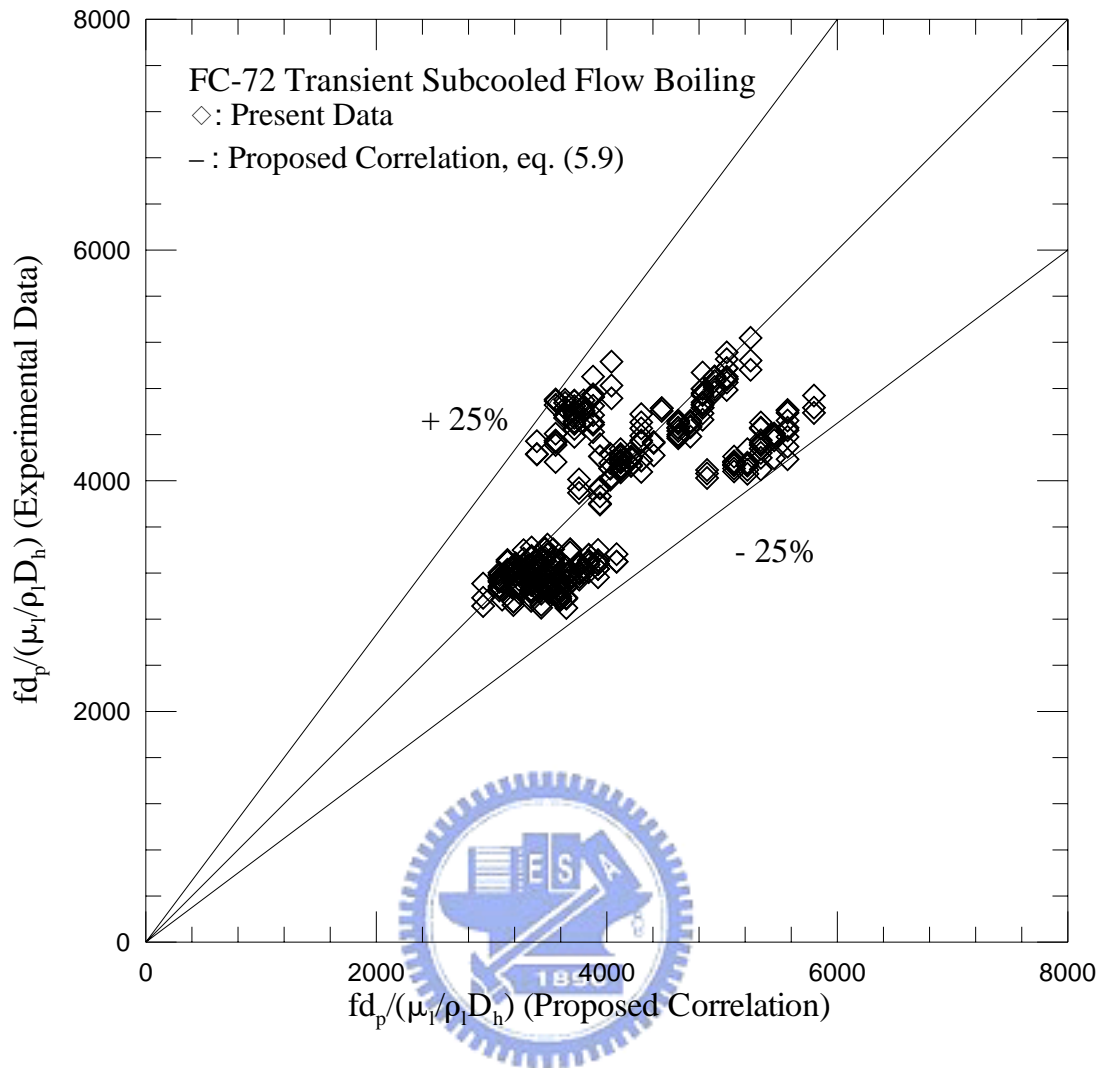
Fig. 5.204 Comparison of the measured data for mean bubble departure frequency for transient subcooled flow boiling of FC-72 with the proposed correlation.
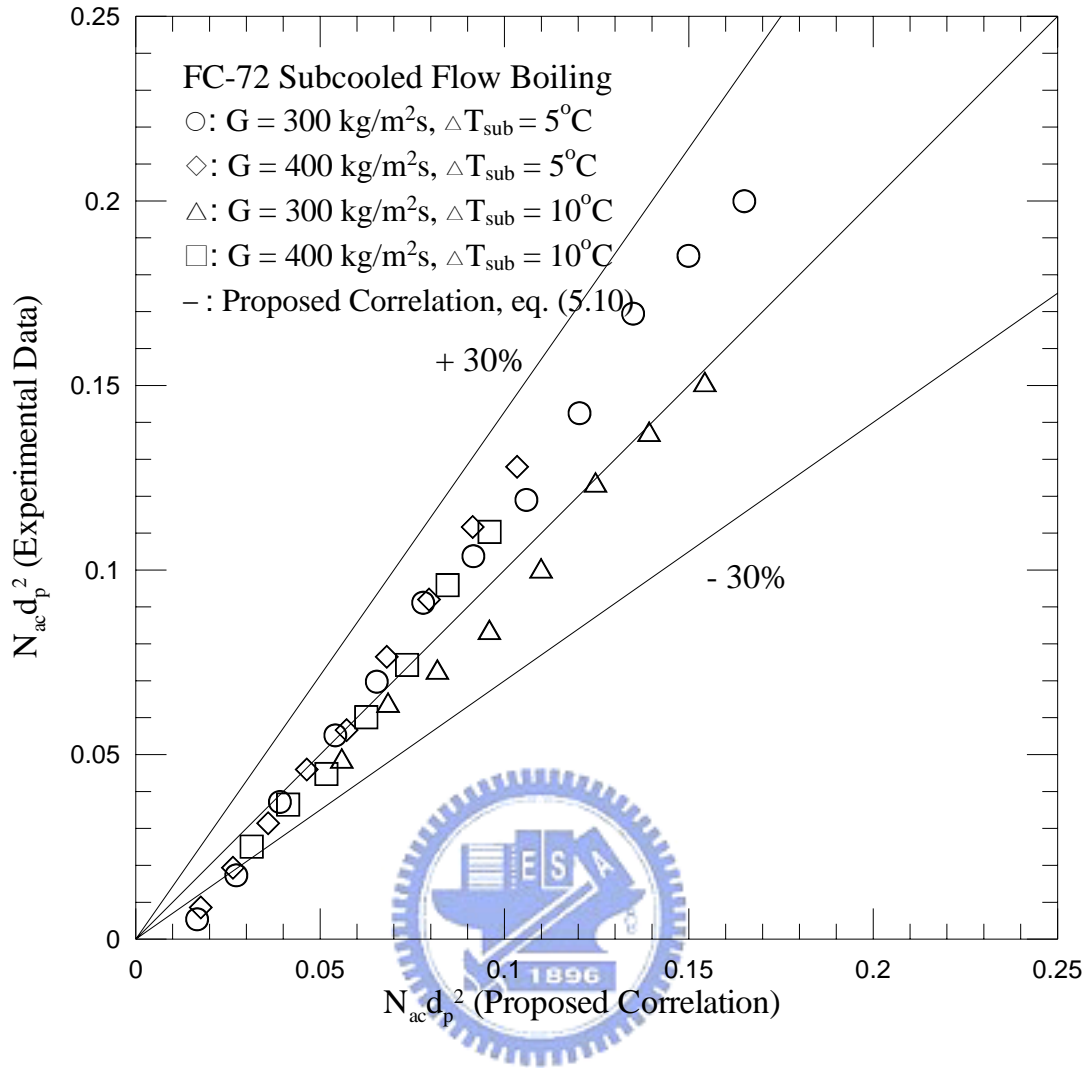
Fig. 5.205 Comparison of the measured data for mean active nucleation site density for subcooled flow boiling of FC-72 with the proposed correlation.
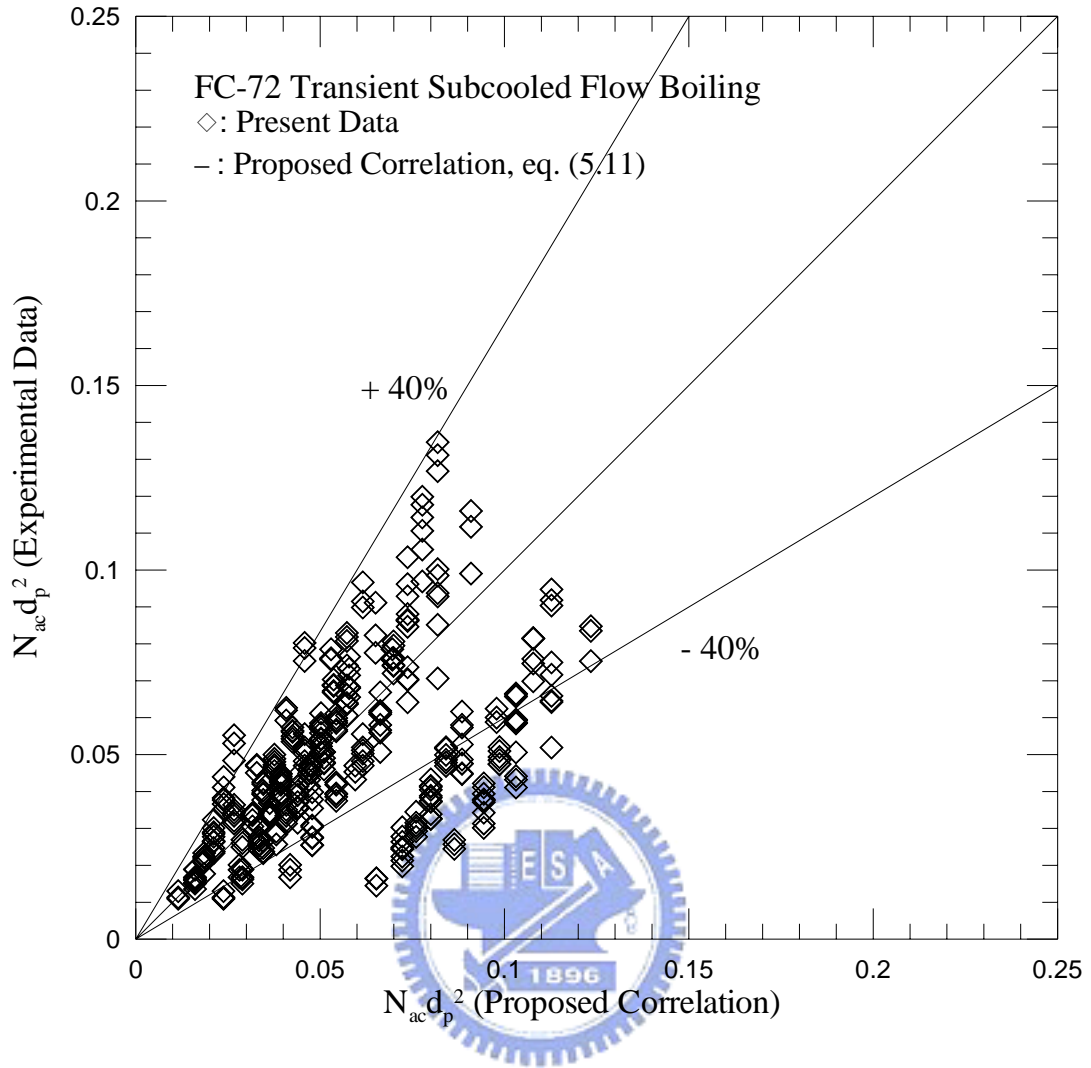
Fig. 5.206 Comparison of the measured data for mean active nucleation site density for transient subcooled flow boiling of FC-72 with the proposed correlation.
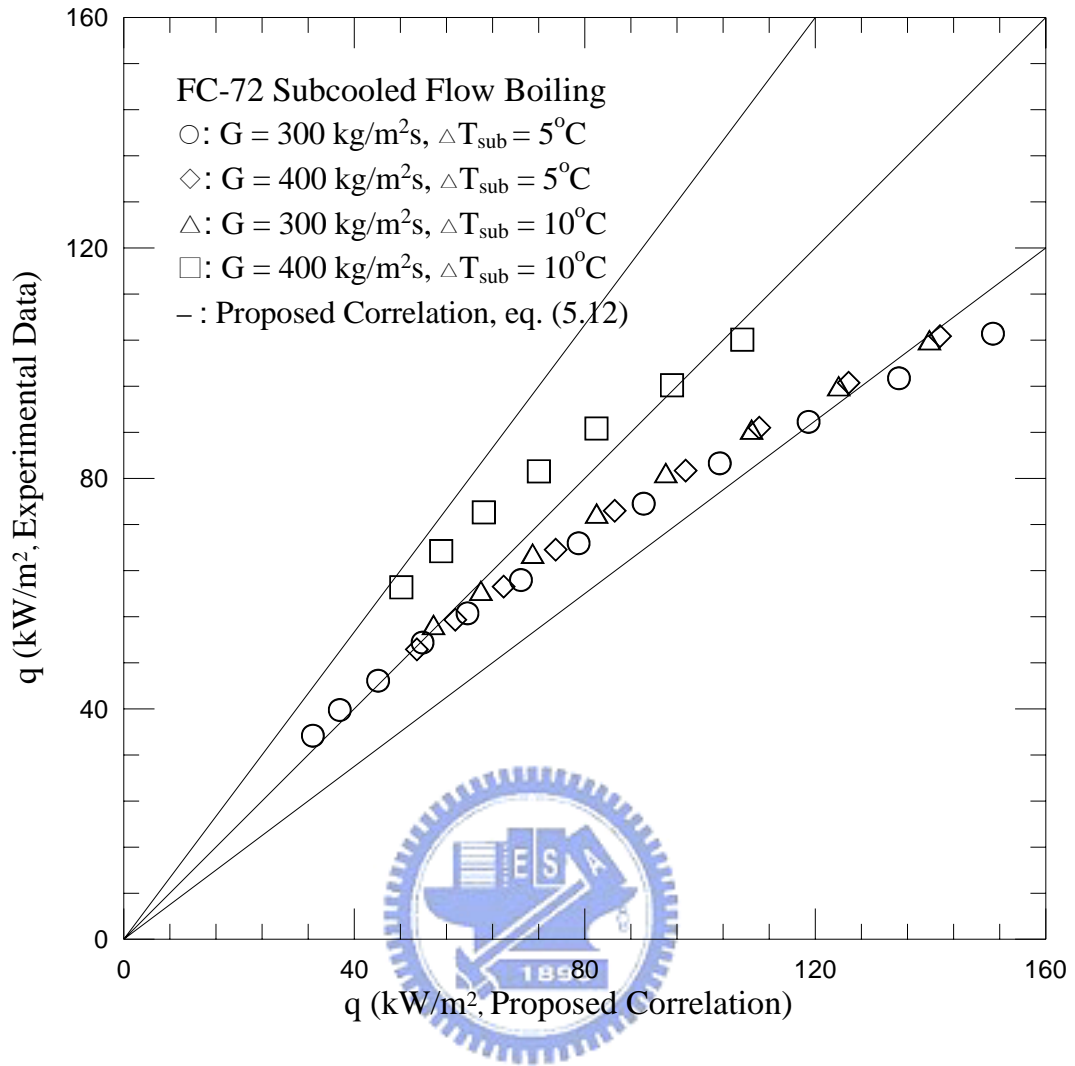
Fig. 5.207 Comparison of the measured data for boiling heat flux for stable subcooled flow boiling of FC-72 with the proposed correlation.