PLASMA-PARTICLE MOMENTUM TRANSFER UNDER CONDITIONS OF GREAT KNUDSEN NUMBERS AND THIN PLASMA SHEATH

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Particle drag and thermophoresis results previously obtained for the case of great Knudsen numbers (free-molecule regime) and thin sheath have been revised by including the modified expressions for ion and electron components of the surface pressure. Two approaches are employed to derive the expressions for ion and electron pressure components and identical results have been obtained. The analysis shows that there is almost no difference between non-evaporating metallic and nonmetallic particles in their drags and there is only a little difference between the two types of particles in their thermophoretic forces. These results are a little different from those given in Refs.[1,2]. The previous expressions for evaporation-added drag [3] or thermophoretic force [4] remains unchanged and the effect of evaporation on drag or thermophoretic force is still quite appreciable. However, the values of the thermophoretic or drag force ratio with to without accounting for evaporation effect are somewhat different from those obtained previously [3,4]. As in [3,4], there still is great difference between evaporating metallic and nonmetallic particles in their drag and thermophoretic forces, especially for the particle materials with low evaporation latent heat at high plasma temperatures.

[1] Xi Chen and Xiao-ming Chen, Plasma Chemistry and Plasma Processing, 9(3), 387 (1989).

[2] Xi Chen and Xin Tao, Plasma Chemistry and Plasma Processing, 12(3), 345 (1992).

[3] Xi Chen, Bingzhi Su and Lan Yu, Plasma Chemistry and Plasma Processing, 15(1), 1 (1995).

[4] Xi Chen and Xin Tao, Plasma Chemistry and Plasma Processing, 14(2), 163 (1994).