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论文

蒸汽相变凝结对PM2.5粒径分布的影响

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摘要：

基于多分散颗粒凝结增长理论，进行不同操作条件（停留时间、饱和度、温度）和PM2.5 特性（粒度、分散度）下相变凝结过程中颗粒粒径分布的研究，分析各参数对颗粒相变凝结增长效果的影响。结果表明：随着颗粒在过饱和蒸汽环境中停留时间的延长，颗粒粒径范围迅速变窄，颗粒由初始条件下多分散分布的微粒转变为单分散分布的粒径较大的含尘液滴；饱和度越大，相变凝结的推动力就越大，颗粒增长更为迅速；相同饱和度下，较高的温度能够促使PM2.5 成长为粒径更大的含尘液滴。研究发现，由于相变凝结后颗粒粒径趋于一致，初始PM2.5 粒径分布（粒度、分散度）对颗粒增长效果影响很小。

关键词： 蒸汽相变；PM2.5 ；过饱和蒸汽；颗粒粒径分布

Influence of vapor heterogeneous condensation on the PM2.5 particle size distribution

Abstract:

Based on the condensation growth theory of polydispersed aerosols，particle size distribution during the heterogeneous condensation process was investigated in this study.Also，the influences of operational conditions (residence time，degree of saturation and temperature) and PM2.5 properties (size and dispersity) on particle growth were tested.The results show that particle size range narrows rapidly as the residence time of particles increase in the supersaturated vapor environment.Consequently，the initial polydispersed fine particles shift to monodispersed micron sized droplets by vapor heterogeneous condensation.Under a higher supersaturation condition，the driving force for vapor condensation is greater and thus，the particles grow more rapidly.In cases with the same level of supersaturation，higher gas temperatures can promote the condensation droplet to grow bigger.It has also been found that the condensation growth effect is not dependant on the initial particle size distribution parameter，such as particle diameter and dispersity because the particle sizes trend to the same value after vapor heterogeneous condensation.

Keywords: heterogeneous condensation；PM2.5 ；supersaturated vapor；particle size distribution

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