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Cluster activation theory as an explanation of the linear dependence between formation rate of 3nm particles and sulphuric acid concentration

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Abstract. According to atmospheric observations new particle formation seems to be a function of sulphuric acid concentration to the power from one to two. The nucleation theorem then predicts that the critical cluster contains one to two sulphuric acid molecules. However, existing nucleation theories predicts that the power is more (or equal) than 2. Here we present an activation theory, which can explain the observed slope. In cluster activation the clusters containing one sulphuric acid molecule will activate for further growth due to heterogeneous nucleation, heterogeneous chemical reactions including polymerization or activation of soluble clusters. In the activation process organic vapours are typically needed as condensing agents.

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