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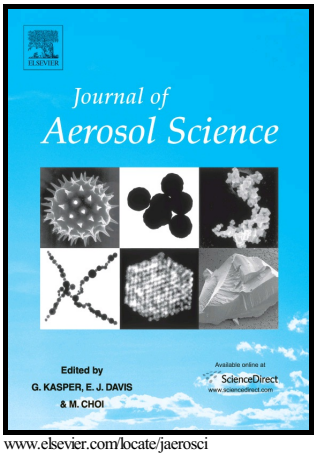


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# Effect of shielding gas temperature on the welding fume particle formation: Theoretical model

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**Abstract**

Inhalable particles formation in gas metal arc welding with various shielding gas temperatures is investigated by fume evolution numerical modeling. The subject of modeling is a single gas parcel of vapor-gas mixture, evolution of which under cooling based on initial temperature and vapor chemical composition is calculated. The welding fume evolution includes vapor emission from arc zone and mixing, plasma formation, nucleation, nuclei growth via material condensation and coalescence, solidification of liquid droplets and primary particles' coagulation into inhalable particles in the breathing zone. The computed results correlates well with experimental dependency of the particle sizes on the shielding gas temperature. Such a dependency is caused by the decrease of vapor-gas mixture cooling rate when the shielding gas temperature is increased, which provides the increase of particles' growth duration which leads to increase of the particle sizes.

*Keywords:* Gas metal arc welding, Numerical modeling, Particle size distribution, Shielding gas temperature

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