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INVESTIGATING THE ABSORPTION PROPERTIES OF METAL NANOPARTICLE AGGREGATES DURING TIME-RESOLVED LASER-INDUCED INCANDESCENCE

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ABSTRACT. Analyzing time-resolved laser-induced incandescence (TiRe-LII) data from metal nanoparticle aerosols requires a detailed understanding of their absorption and emission characteristics. This work investigates how non-uniform absorption within metal nanoparticle aggregates, aggregate orientation, and sintering of primary particles may affect TiRe-LII signals from metal aerosols. The multi-sphere T-matrix method is used to compute the absorption properties of aggregates with point contact between primary particles, while the discrete dipole approximation method is used when primary particles overlap. It was found that absorption non-uniformities within aggregates increase with increasing aggregate sizes, and may contribute to excessive absorption and anomalous cooling effects. For the aggregates considered, the total absorption cross-section depends weakly on orientation. It was also found that primary particle overlap of about 20–30 %, resulting from partial sintering, can enhance the absorption cross-section of the aggregate.

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