The model of photoacoustic effect in liquid metal colloids

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A model of metal nanoparticles in a liquid inert matrix heating with laser pulse is suggested. The model takes into account the following processes:

- Evaporation of the matrix and metal if the temperature exceeds the respective boiling points.
- Heat transfer in the system nanoparticle–matrix or nanoparticle–vapor shell–matrix.
- Light absorption by the nanoparticle dependent on the vapor shell thickness.
- Fast pressure relaxation in the irradiated area treated in terms of the mechanical quasiequilibrium approximation.

The simplification concerned upon quasistationary concentration of metal and solvent molecules in vapors was as well as for heat fluxes at the boundaries was suggested. This simplification gives the character metal and vapor temperatures estimation using the maximal pressure value. The estimations in the case of aluminum colloid in DMSO (dimethyl sulfoxide) matrix at the pressure 1.6 MPa leads to metal temperature of 4100 K. The absorption cross section estimations agree well with predictions in terms of the Aden–Kerker theory. The work is supported by grant No. MD-3502.2021.1.2 from the President of the Russian Federation.