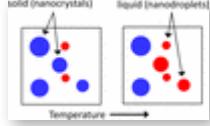


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Novel methodology to determine thermal properties of nanoparticles exclusively based on SAXS measurements applied to Bi nanocrystals and nanodroplets in a glass matrix

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A novel methodology is presented to determine thermal properties of polydisperse nanocrystals and/or nanodroplets embedded in a homogeneous matrix using small-angle X-ray scattering (SAXS). It is based solely on SAXS measurements at multiple temperatures and multiple moduli of the scattering vector. The proposed methodology can quantify the linear coefficients of thermal expansion of confined spherical nanocrystals and/or nanodroplets and the radius dependence of the melting temperature of confined spherical nanocrystals, even in samples with a broad size distribution. It is described through its application on a nanocomposite consisting of Bi nanocrystals/nanodroplets embedded in a sodium borate glass matrix. The

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that of bulk crystalline Bi, and the coefficient of liquid Bi nanodroplets was 25% smaller than that of bulk liquid Bi. The melting temperature of the spherical Bi nanocrystals decreased by *ca* 130 K when particle radii decreased from 82 to 23 Å. Even though SAXS measurements are generally expected to provide low-resolution structural parameters, this demonstrates that this technique allows for the characterization of rather weak temperature-dependent variations of size parameters during *in situ* heating processes and across melting transitions.

Keywords: **small-angle X-ray scattering; melting; nanocrystals; nanodroplets; glass matrices; nanoparticles; thermal properties.**

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