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Polydispersity analysis based on a unified exponential/power-law approach to small-angle neutron scattering

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Small-angle neutron scattering in the comprehensive analysis of particulate systems brings a number of benefits in a deeper understanding of physicochemical processes. The method is capable of providing a detailed structural description at the mesoscale level. Such a description must contain information about polydispersity. There are many approaches to determining the size distribution function. Nevertheless, they all include certain integral equations, which can introduce additional mathematical artifacts. Beaucage *et al.* proposed an alternative approach [1]. They took into account that each of the parameters of the Guinier and Porod equations is proportional to some moment of the size distribution function. This is the basis for an approach that makes it possible to analytically calculate the parameters of a lognormal distribution based on a dimensionless combination of parameters, designated as PDI. We consider the possibility of using additional scattering invariants, such as the Porod integral or the correlation length (weight-averaged chord length), to construct an additional polydispersity index containing lower distribution moments compared to the PDI from [1]. This makes it possible to determine the parameters of polydispersity functions other than lognormal analytically. The cases of normal, Boltzmann, uniform, triangular, Schultz and exponential distributions are considered in detail.
[1] Beaucage G. *et al.*, *J. Appl. Cryst.* **37** (2004) 523.

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