Nanoparticle Reference Materials: Lessons Learned and the Case for Concentration Measurements

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The importance of reference materials in support of a broad range of applications and needs within the nanotechnology field has been frequently discussed and debated.[1,2] That reference materials have played a substantial role in method development and validation, interlaboratory comparisons, instrument calibration, quality control and basic research, is clear and well documented. This presentation will discuss the procedures and unique challenges associated with the selection, development, certification and use of nanoscale particle reference materials, drawing upon lessons learned from over 10 years of experience. The development of reference materials is closely tied with measurement technology, and has both enabled advances in measurement science and benefited from such advances. The majority of nanoscale particle reference materials have served primarily as size measurement standards, though multiparametric standards have proven more broadly useful. More recently, an increased emphasis on the capacity to quantify nanoparticle number concentration has been driven by policy decisions in the EU.[3] The effort to develop measurement methods to quantify particle number concentration and, by extension, number size distributions, has accelerated. However, the lack of reference materials designed specifically to validate these methods has clearly hampered progress in this area. The additional challenges and requirements for development of reference materials appropriate for concentration calibration will be explored in this context.

1. " Nanoscale reference materials for environmental, health and safety measurements: needs, gaps and opportunities", A. B. Stefaniak, V. A. Hackley, G. Roebben, K. Ehara, S. Hankin, M. T. Postek, I. Lynch, W-E. Fu, T. P. J. Linsinger, & A. F. Thünemann, *Nanotoxicology*, 7, 1325 (2013).

2. "Reference nanomaterials to improve the reliability of nanoscale measurements", G. Roebben, V.A. Hackley & H. Emons, Chapter 19, pp.307-322 in *Metrology and Standardization for Nanotechnology*, Wiley-VCH:Weinheim, Germany, 2017.

3. Recommendation on the definition of a nanomaterial (2011/696/EU)