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EDITORIAL COMMENT

Correction and comment on "thermal conductance of nanofluids: is the controversy over?"

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In the October 2008 (No. 7, pp. 1089–1097) issue of the Journal of Nanoparticle Research, Keblinski et al (2008) published an article entitled "Thermal conductance of nanofluids: is the controversy over?". Besides brief review of heat transfer mechanisms and controversy on nanofluids, the article also brings out an effective medium theory-based classical model (Hashin and Shtrikman 1962) to predict the effective thermal conductivity of nanofluids. This is a very interesting article. It intercalates a mechanism (aggregation of particles), which was previously considered ineffective (Keblinski et al. 2002), and denies most of the highlighted mechanisms such as particle size, Brownian motion, micro-convection, and dispersion (e.g., Jang and Choi 2004; Chon et al. 2005; Koo and Kleinstreuer 2004; Prasher et al. 2005; Hong and Yang 2005) for the enhanced thermal conductivity of nanofluids. Unfortunately, the article contains two sets of wrong thermal conductivity data.

Under Section "Discussion" two graphs in Fig. 1 on p. 6 of Keblinski et al.'s (2008) article, the authors surprisingly presented thermal diffusivity results for Al/EG (ethylene glycol) and Al/engine oil-based nanofluids obtained from literature (i.e., Murshed et al. (2006)) as the thermal conductivity data of these nanofluids. These must be corrected. There are also typos in author's name of the cited article spotted at the top of those two graphs in Fig. 1.

According to the argumentation of Keblinski et al (2008), if aggregation of particles is responsible for the reported anomalously high thermal conductivity of nanofluids, the use of surfactant and sonication, which works against agglomeration or clustering and improve dispersion of nanoparticles in the base fluid resulting in higher thermal conductivity (Xie et al. 2003; Murshed et al. 2005; Hong and Yang 2005; Yu et al. 2008), are insignificant. Some researchers (e.g., Karthikeyan et al. 2008; Hong and Yang 2005, Hong et al. 2005) also showed that the effective thermal conductivity of nanofluids decreases (or increases) with increasing elapsed time (or sonication time) due to clustering of nanoparticles, which increases with elapsed time and decreases with sonication time. In addition, it is so far undisputed that the smaller the particle size, the higher the effective thermal conductivity of nanofluids (e.g., Kumar et al. 2004; Jang and Choi 2004; Chon et al. 2005; Yu et al. 2008). These aforementioned issues (use of surfactant and sonication, elapsed time of the sample fluid, and particle size etc.) are generally contrary to the aggregation argumentation provided in the article of Keblinski et al (2008) to explain the enhanced thermal conductivity of nanofluids.

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Keblinski et al. (2008) did not provide any thermal conductivity data for the base fluids and the particle materials used in calculating the effective thermal conductivities of those nanofluids by Hashin–Shtrikman's (H–S) model (Hashin and Shtrikman 1962). H–S model was also justified for TiO_2/water-based nanofluids [Fig. 1 on p. 5 in Keblinski et al. (2008)] and the data were obtained from an article of Murshed et al. (2005). However, by using correct values of thermal conductivities of TiO_2 nanoparticle and water, which are 8.40 W/m·k (Masuda et al. 1993) and 0.607 W/m·k (Kaviany 2002), respectively, H–S upper bound model gives fairly lower results than the results reported in Fig. 1 (Figure for TiO_2–water). Furthermore, Zhang et al.'s (2006) effective thermal conductivity data for this nanofluid which was measured at 10 °C (*NOT* at room temperature) was provided in the same figure.

Nevertheless, more systematic and careful investigations are needed to resolve the controversy over the mechanism of the enhanced thermal conductivity of nanofluids as well as to minimize the discrepancies in the results from different research groups.

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