To the Editor:

In "Aggregation Structure and Thermal Conductivity of Nanofluids," (April 2003), Xuan and Li proposed a theoretical model to predict the effective thermal conductivity of nanofluids. The model expressed by Eq. 13 is not valid, because it is based on a wrong expression, Eq. 10.

Our observation can be demonstrated on the following dimensional analysis of Eqs. 3 and 10:

Equation 3 gives the statistically averaged square value of particle displacement

$$\overline{x^2} = \frac{k_B T}{3\pi r_c \eta} t \tag{3}$$

From the righthand side, we know that the unit for Boltzmann constant is *J/K*; for temperature: *K*; for radius: *m*; for viscosity: *Kg/(m*s)*, where the unit for energy (*J*) is *N*m*, or *Kg*(m/s)**2*. Pluging these units into the righthand side of Eq. 3, we get

$$\frac{k_B T}{r_c \eta} t \sim \frac{\frac{J}{K} \cdot K}{m \cdot \frac{Kg}{m \cdot s}} \cdot s \sim \frac{J \cdot s^2}{Kg}$$

$$\sim \frac{N \cdot m \cdot s^2}{Kg} \sim \frac{Kg \cdot \frac{m}{s^2} \cdot m \cdot s^2}{Kg} \sim m^2 \tag{a}$$

which is consistent with the dimension of the lefthand side of Eq. 3, $\overline{x^2}$. Also from the above analysis, we know that the dimension for the factor before t is

$$\frac{k_B T}{3\pi r_c \eta} \sim \frac{m^2}{s} \tag{b}$$

So obviously, Eq. 10, which is given in the article as follows

$$l = \sqrt{\frac{k_B T}{3\pi r_c \eta}} \tag{10}$$

is not physically meaningful because taking square root of (b) above does not make any sense. It should be like the following

$$l = \sqrt{\frac{\frac{k_B T}{3\pi r_c \eta}}{\tau_c}} \tag{c}$$

where τ_c is a time scale to be determined.

From the above analysis, we may conclude that the theoretical model represented by Eq. 12 is not valid.

I will appreciate an explanation from the authors. I am developing a Nanofluid simulation models and I need to resolve this technical issue as soon as possible.

Literature cited

Y. Xuan and Q. Li, "Aggregation Structure and Thermal Conductivity of Nanofluids," *AIChE J.*, 49(4), 1038 (2003).

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Reply:

According to the following formula

$$\overline{x^2} = \frac{k_B T}{3\pi r_c \eta} t$$

we consider the displacement of the particles within unit time, that is, $t = 1$ s. In this case, the displacement is obtained as

$$l = \sqrt{\frac{k_B T}{3\pi r_c \eta}}$$

This is Eq. 10.

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