An Experimental Investigation of Flow-Induced Assembly of Nickel Nanoparticles

by

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ABSTRACT

Lead telluride and bismuth telluride exhibit the peak value of about 1 for figure of merit (ZT) of bulk thermoelectric materials; the figure of merit is a measure of efficiency for thermoelectric energy conversion. ZT of 2-3 is necessary for thermoelectric devices to have widespread, practical applications in fields such as regenerative power recovery. Nanoscaled thermoelectric materials have surpassed this criterion, however, the scale-up of these nanostructured materials while maintaining the desired properties has proven to be challenging. Here we investigate flow-induced assembly of nickel nanoparticles at a gas/liquid interface. Nickel nanoparticles are spread on the surface of water using techniques developed for Langmuir monolayers. Interfacial shear is produced from annular Couette flow through a stationary inner cylinder and rotating outer cylinder. The Reynolds number is large enough to produce a shearing motion at the interface to assemble the particles into a film.