Effect of Carbon Nanotube Aqueous Dispersion Quality on Mechanical Properties of Cement Composite

Ilya V. Anoshkin¹, Larisa I. Nasibulina¹, Albert G. Nasibulin¹, Andrzej Cwirzen², Vesa Penttala² and Esko I. Kauppinen¹

¹Department of Applied Physics, Aalto University School of Science and Technology, Puumiehenkuja 2, 02150, Espoo, Finland (ilya.anoshkin@aalto.fi);
²Department of Civil and Structural Engineering, Aalto University School of Science and Technology, Rakentajanaukio 4 A, 02150 Espoo, Finland.

An effect of the quality of carbon nanotube (CNT) dispersions added to cement on paste mechanical properties has been studied. High-quality dispersions of few-walled CNT (FWCNTs) were produced in two steps. First, FWCNTs were functionalized in a mixture of nitric and sulfuric acids (70wt.% and 96wt.%, resp.) at 80°C. Second, functionalized FWCNTs were washed out by acetone to remove carboxylated carbonaceous fragments (CCFs) formed during CNT oxidation. Mechanical test results showed 2-fold increase in the compressive strength of the cement paste prepared from the dispersion of acetone-washed functionalized FWCNTs, which is believed to occur due to the chemical interaction between cement matrix and functional groups (–COOH and –OH). Utilisation of unwashed FWCNTs led to a marginal improvement of mechanical properties of the cement pastes, whereas surfactant-treated functionalized FWCNT dispersions only worsened the mechanical properties. [1]