Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Impact and Penetration of Nanoparticle Suspension Drops into Porous Membranes[1] RAKESH SAHU, ALEXANDER YARIN, Univ of Illinois - Chicago, BEHNAM POURDEYHIMI, North Carolina State University — The impacts and dynamic penetration of drops with suspended nanoparticles into porous membranes are studied experimentally and theoretically. This type of penetration is radically different from the wettability-driven imbibition. Two types of membranes are used in the experiments: (i) glass fiber filter membrane (wettable) and (ii) PTFE depth filter (non-wettable). The nanoparticle entrainment and deposition inside the membrane bulk is used to mostly visualize the ultimate penetration fronts of the carrier fluid by observing the cut cross-sections of the filter membranes, albeit also provides an insight into potentially new applications like circuit printing on nonwovens. The experimental results demonstrate that during the dynamic focusing responsible for water penetration into micro- and nanopores, water can penetrate into a non-wettable porous medium (PTFE). Water also penetrates by the same focusing mechanism into the wettable glass fiber membrane, where it additionally spreads on a much longer time scale due to the wettability-driven flow. A theory explaining dynamic penetration of liquid into porous medium after drop impact is proposed. It is used to explain and predict water penetration into the non-wettable media after drop impact, and the results are compared with the experimental data.

[1]The work was supported by the Nonwovens Cooperative Research Center (NCRC)

Rakesh Sahu
Univ of Illinois - Chicago

Date submitted: 13 Nov 2013 Electronic form version 1.4