Perspectives of materials processing: present and the future

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With recent advances in materials and products, materials processing experiences new challenges. More particles and polymers in material side and thinner and faster deformations in processing side. It happens in most emergying industries such as manufacturing of batteries, solar cells, multi-layer chips, displays, printed electronics, to list a few. In most cases, they are manufactured by coating process, which is defined as a process in which gas is replaced by liquid on a substrate. In this sense, casting, inkjet printing, and roll-to-roll printing are all included. The coating process consists of three unit processes. As the materials used in the above mentioned applications typically contain a large amount of particles with polymers and solvents, they continuously change microstructures during preparation, flow, and even drying. However, little is known about the flow characteristics of such complex fluids and less is known about how to design and control the process. Therefore, for better control of the process and for better quality of the product, we need to understand the flow characteristics of these complex fluids under extremely fast flow environment. It will be a big challenge to establish a systematic protocol to characterize the coating material and maintain the uniform quality of coating materials during manufacturing at all times.