ANALYSIS OF INDUSTRIAL REACTIVE POWDERS FLOW PROPERTIES AT HIGH TEMPERATURE

Domenico Macri, Department of Chemical Engineering, University College London, UK
domenico.macri.14@ucl.ac.uk
Massimo Poletto, Diego Barletta, Dipartimento di Ingegneria Industriale, Università degli Studi di Salerno, Via Ponte Don Melillo, 84084 Fisciano (SA), Italy
Stephen Sutcliffe , Fisciano (SA), Italy
Huntsman Pigments ,Additives, Greatham Works, Tees Road, Hartlepool, TS25 2DD, UK
Paola Lettieri, Department of Chemical Engineering, University College London, UK

The Chemical Industry Association reports that most of chemical products currently in production involve the use of particles at some stage in the manufacturing process. Particle science and technology are essential to the improvements of many types of consumer products (including polymers, paints, food and healthcare, to mention just a few) and tackle most contemporary grand challenges, such as in advanced manufacturing, sustainable energy, waste management, and food preservation. To this end, fluid bed reactors are usually used. They are particularly useful in high temperature systems where the fluidization behaviour allows particulate materials to be handled at a higher temperature than in a static system.

However, fluid bed operations at elevated temperatures are usually limited by a tendency of the particles to form agglomerates, thus causing the bed to defluidize. This may occur at temperatures well below the normal particles' melting point, and has been encountered in different processes, including the carbo-chlorination reaction involving titaniferous materials. This phenomenon is a result of a strong particle-particle interaction causing more rapid rate of sintering.

Several studies have highlighted that the phenomena involved are extremely complex, and that a direct quantification of the particle-particle interactions and their changes with temperature remains a challenge. The objective of this paper is to report preliminary experimental observations on the effect of temperature on the flow behaviour of various titanium ore powders. To this end, both fundamental fluidization and rheological measurements will be performed to assess indirectly the particle-particle interactions at high temperature. The former will be performed using a unique high power pulsed X-ray Imaging technique, while a High Temperature Annular Shear Cell available at the University of Salerno will be used to characterize the rheological properties of such particles.