DEM-CFD Analysis of Particle Attrition in a Cyclone

F.Fulchini[1], M. Ghadiri[1*], A. Borissova[1], M. Yazdan Panah[2], S. Bertholin[3], B. Amblard[3], A. Cloupet[3], T. Gauthier[3]

[1]Institute of Particle Science and Engineering, University of Leeds, Leeds, UK

e-mail:pm14ff@leeds.ac.uk

[2]TOTAL Refining – Chemicals Research & Development, Le Havre, France

[3]IFP Energies nouvelles, Lyon, France

*** Corresponding author: Prof. Mojtaba Ghadiri**

Email address: M.Ghadiri@leeds.ac.uk

ABSTRACT

Cyclones are used in the Chemical Looping Combustion (CLC) process to separate entrained particles from the flue gas streams. Particles entering a cyclone are subjected to a radial centrifugal force field, driving them to the cyclone walls, where they experience collisional and rapid shearing stresses. For frangible particles this could lead to attrition and dust generation, whilst for hard particles wear of cyclone wall could occur.

In this work we address the issue of attrition of manganese oxide particles used in the CLC process. A CFD-DEM analysis of particle motion and interactions is used to calculate the frequency of collisions, impact velocities and shear stresses. These are then coupled with an impact breakage model and a model for surface wear to predict particle attrition in a cyclone. The outcome of the work is presented, providing a correlation of the attrition extent as a function of particle properties and operating conditions.