STUDY OF A POWDER FEEDER FOR NANOPARTICLE PRODUCTION

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The production of particles into thermal plasmas have been of considerable interest for some time. This interest stems from a variety of industrial applications, e.g. plasma spray coating, that makes the understanding of the basic processes involved in thermal treatment of powders in a plasma a necessity.

The success for the production of nanoparticle on a ICP is strongly dependent in the controlled feed rate system. It has been observed that instabilities in the powder feed rate due to irregular particle shape and poor flowability requires more sophisticated powder feeding devices in order to avoid undesirable nano-micro structures. This is due to the heat extracted by the powder from the plasma changing dramatically the thermodynamic and transport properties of the plasma gas, and poor evaporation and melting.

Cyclone separators have been one of the most popularly used industrial devices form separating dispersed particles from their carrying fluid. There applications spans from industrial applications to selective sampling of various air-laden particles in environmental control.

The feasibility of a cyclone separator to provide a sharp cut-off diameter in a powder feeder was studied. It was found that the flow pattern within the cyclone is highly complex and not yet completely understood. The theoretical models, due to the assumptions, provide coarse results and a proper design is mostly based on experience. Nevertheless, CFD could shed some light upon the complex behaviour of the flow and it was studied the dynamic behaviour of the flow within the cyclone. Based on the steady approach, the collection efficiency was determined and a experimental validation performed in order validate the numerical results.

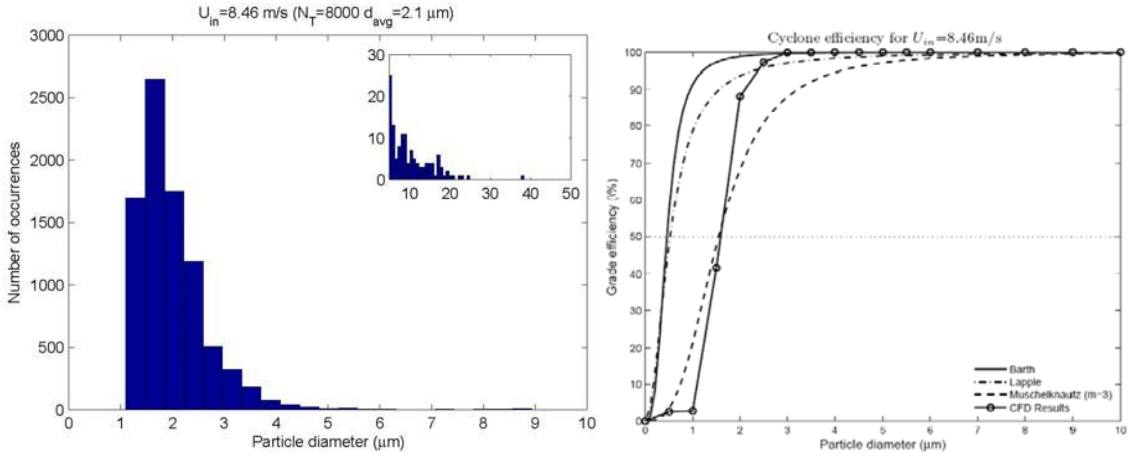

Figure 1: Experimental and Numerical results for the cyclone efficiency