354a Synthesis of Non-Oxidic Nano Scale Materials Using Flame Technology

Robert N. Grass and Wendelin J. Stark

The current need for computer power has pushed chip manufacturing to UV-applications using 193 and 154 nm lithography. A major hurdle towards such large scale applications is the cost effective production of high purity fluoride crystals and glasses. Current fiber optics rely on doped silica that is manufactured in a flame process for its inherently low entrainment of impurities. Such impurities result in scattering centers and signal loss upon transmission. The present work describes a method to prepare metal salts, especially halides by a similar flame process and extends the similar, yet existing technology to this novel material class. Among the different halide salts, mainly fluorides have wide applications in optics as windows, lenses, scintillation crystals and as host crystals for rare earth ions (Ho, Er, Eu, Nd, Ce) exhibiting interesting properties in optoelectronics such as lasing, light amplification and upconversion.

We show the manufacture of halide salts such as BaF_2, SrF_2, CaF_2 and NaCl at high purity maintaining large surface areas. Optional rare earth metal doping gives the possibility of creating high value optics for applications such as in optical fiber manufacture as well as IR applications and lasing materials.

Reference: R.N. Grass and W.J. Stark, Chem. Commun, 2005, 1767 – 1769.

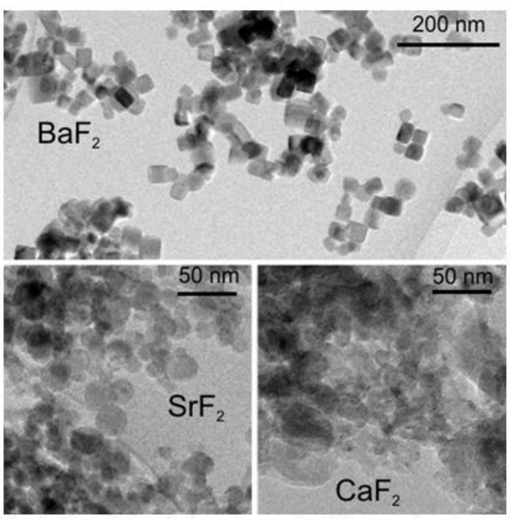

Fig. 1 Transmission electron micrograph of flame-made earth alkali fluorides. The powders show high crystallinity and low agglomeration in the case of BaF_2.

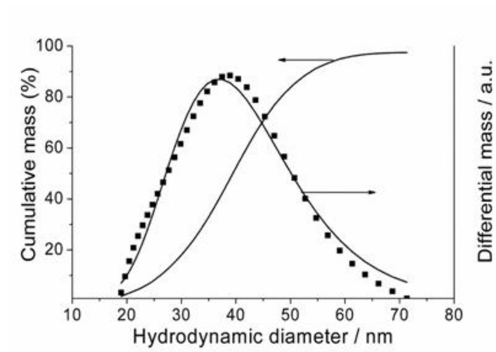

Fig. 2 Cumulative and differential particle size distribution of the BaF_2 dispersed in ethylene glycol, measured by X-ray disc centrifuge. The dotted line shows the best lognormal fit to the data with a geometric standard deviation of 1.33 consistent with theoretical calculations.