SYNTHESIS OF SILICA NANOPARTICLES IN TURBULENT NONPREMIXED FLAMES WITH OXYGEN ENRICHMENT

S.H. Bae\textsuperscript{1}, H.D. Shin\textsuperscript{1}\textsuperscript{*}
\textsuperscript{1}Korea Advanced Institute of Science and Technology, Korea
\texttt{hdshin@kaist.ac.kr}

Silica nanoparticles were made by gas-to-particle conversion of tetraethylorthosilicate (TEOS) in coflow turbulent nonpremixed flames with oxygen enrichment. The effects of flame residence time and temperature distribution on the degree of agglomeration and the primary particle diameter of silica nanoparticles were investigated. The laminar flame length was measured by direct photos and chemiluminescence images using camera and intensified charge-coupled device (ICCD) camera, respectively, and then we expanded the definition of the flame length in the normal laminar nonpremixed flame to the normal turbulent nonpremixed flame with oxygen enrichment. The primary particle diameter of silica nanoparticles is quantitatively measured by transmission electron microscopy (TEM) and the degree of agglomeration of silica nanoparticles was qualitatively confirmed by TEM. The flame temperature was measured by Coherent Anti-Stocks Raman Scattering (CARS) because flame temperature was so high. We investigate the generation of silica nanoparticles on the effect of residence time using TEOS in turbulent nonpremixed flames burner controlled by providing reactant flowrate and burner geometry.

Fig. 1 shows the residence time obtained from the flame length measured by OH -chemiluminescence images and the primary particle diameter of silica particles measured by TEM images. The residence time decreases as the fuel flow rate increases. The primary particle diameter of silica particles decreased as the fuel flow rate increases.

![Fig. 1 Residence time and primary particle diameter according to fuel flowrate](image)

Particle size and morphology are performed with TEM using thermophoretic sampling method. Fig. 2 shows the TEM micrographs of silica nanoparticles of the fuel velocity from 40 to 90 m/s at oxygen mole fraction: 0.5. The primary particle size decreases and aggregate size decreases as fuel velocity increases.

![Fig. 2 TEM micrographs of silica nanoparticles](image)