The Flame Synthesis of TiO_2 Nanoparticles and Its Computational Analysis for Aerosol Flame Deposition Process

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The aerosol flame deposition (AFD) process is capable of preparing nano-sized metal oxide films from liquid precursors. In our work, we prepared titania thin films via the pyrolysis of titanium tetra-isopropoxide (TTIP) precursor by using AFD process. The flame torch was moved zig-zag in an x and y directions for uniform deposition of the thin films. TTIP was carried by N2 gas into the central tube of the torch and was decomposed in oxy-methane flame to form TiO2 particles and, subsequently, deposited on glass substrate. On the one hand, by changing the various process parameters, TiO2 nanoparticles of the different average sizes with narrow distribution was prepared. On the other hand, the optimized conditions was investigated for preparing the uniform films. The evolution of flame-made TiO2 particles from spherical to weakly agglomerated ones has been investigated. The axial and radial flame temperatures were monitored during flame synthesis of TiO2 particles to examine the dependability of numerical simulation. In this study, we used CFD-code FLUENT to simulate the flame temperature and velocity profiles for the decomposition of TTIP in the oxy-methane flame.