# ABSTRACT

In the present study a modified sol-gel method is developed. This modified sol-gel method is utilized for synthesis of a series of multicomponent mixed oxide ceramic powders. Here water is used as the common solvent for the starting materials instead of the commonly used solvent for preparation of multicomponent silicate gels. Tetraethoxysilane (TEOS) is used as the starting material for the silicate component. Metal formates are used as starting materials instead of costly metal alkoxide, for corresponding metal oxide. To confirm the validity of this modified sol-gel method, in the present course of investigation this technique is applied to obtain a variety of silicate systems, i.e., (i)$BaO.SiO_2$ (ii)$3Al_2O_3.2SiO_2$ (iii)$3Al_2O_3.2SiO_2.ZrO_2$ (iv)$Li_2O.Al_2O_3.2SiO_2$ (v)$Li_2O.Al_2O_3.2SiO_2.ZrO_2$ (vi)$Li_2O.Al_2O_3.4SiO_2$ (vii)$Li_2O.Al_2O_3.4SiO_2.ZrO_2$. A detail study of formation of the desired ceramic powders was performed using X-ray diffraction, Infrared spectroscopy, and Thermal analysis. Size and morphology of the ceramic particles formed on calcination of the samples at selected temperatures in air have been studied with electron microscopy (TEM). The homogeneity of the mixed-oxide multicomponent ceramic silicate powders, prepared by this aqueous sol-gel method has been found to be comparatively better than that obtained using the conventional high temperature ceramic methods. The precursor mixture in this particular method, easily yielded a single phase material on calcination at an elevated temperature. It has been found that the compositions having $ZrO_2$ as one of the components always have a significant fraction of the tetragonal zirconia as a minor phase. This modified sol-gel method has proved its utility for synthesis of a wide range of multicomponent silicate powders at effectively low temperatures and offers a cost-effective and technically simple alternative to the rather expensive all-alkoxide sol-gel method.

**KEY WORDS: Sol-Gel, Mixed-Oxide ceramics, Silicates, Dental composite, Mullite, Eucryptite, Spodumene, Zirconia.**