# VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

Project Report on

## Sintering Characteristics Of Nano Alumina Prepared By Sol-Gel Method

Submitted in partial fulfilment of the requirements for the award of

Bachelor of Engineering
In
MECHANICAL ENGINEERING


Submitted By

| | |
|---|---|
| **Bigyan Jyoti Choudhary** | **1MV05ME018** |
| **Rajesh Ranjan** | **1MV07ME078** |
| **Shyam Narayan Mishra** | **1MV07ME099** |
| **Vinay Krishna Piduru** | **1MV07ME114** |

**Under the Guidance of**
**Internal Guide: Mr. A.J.K Prasad**



**DEPARTMENT OF MECHANICAL ENGINEERING**

**SIR M VISVESVARAYA INSTITUTE OF TECHNOLOGY, BANGALORE**


Academic year: 2010 – 11

# PROJECT SYNOPSIS

## SYNTHESIS AND CHARACTERIZATION OF NANO ALUMINA POWDER

Using commercially available aluminium wire (99.8 electrical grade), Nano Alumina has been produced by Sol Gel method. Sol Gel method comprises of the following steps

1. Dissolution of electrical grade commercially available aluminium wire in 30% NaOH solution and converting it into sodium aluminate.
2. Filtration to remove dirt or grease and to get pure sodium aluminate solution.
3. Conversion of sodium aluminate to aluminium isopropoxide by refluxing equal volume of sodium aluminate and isopropyl alcohol for about 24 hrs. For complete conversion of sodium aluminate to aluminium isopropoxide. ($C_3H_6OAl$)
4. Distillation to recover unspent isopropyl alcohol.
5. Neutralization of aluminium isopropoxide (which is in the basic range) with dilute hydrochloric acid to bring the p H near neutral range, in this step (solution of aluminium hydroxide $Al(OH)_3$ is produced).
6. Gradual neutralization to the near neutral range, formation of nano aluminium hydroxide ( $Al_2(OH)_3$).
7. Repeated washing of Gel with distilled water to remove residual chloride ions.
8. The absence of chloride ions has been revealed by the appearance of a clear solution when treated with dilute silver nitrate solution.
9. The resulting Gel has been dried at room temperature in the forced circulation of air.

The nano alumina thus obtained has been characterized by scanning electro microscopy (SEM) and EDAX, transmission electron microscope (TEM). The particles were in the nano range i.e. within 1nm to 100 nm.

The nano alumina powder has been pelletized to 4mm length with 3 mm diameter pellets using wax as a binder at 10 tones compressive load using paraffin wax as binder. Pallets has been sintered at 900°C for 12 -18 hrs. Theoretically when 5% of wax is used the volume of the sintered alumina will be $V_o * 0.95$ where $V_o$ is the volume of the green pellet.