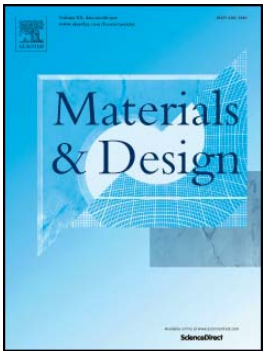

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Title Page

Basic Zinc Carbonate as a Precursor in the Solvothermal Synthesis of Nano Zinc Oxide

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ABSTRACT: ZnO nanoparticles were synthesized solvothermaly in various diols (ethylene glycol, di(ethylene glycol), tetra(ethylene glycol), 1,2-propanediol, 1,4-butanediol), using basic zinc carbonate ($2ZnCO_3 \cdot 3Zn(OH)_2$) as a precursor for the first time. Since $ZnCO_3$ was sparingly soluble in diols the transformation reaction proceeded at a low reaction rate. Ethylene glycol was found as the most suitable medium among five diols studied yielding the smallest ZnO particles (~55 nm) and short reaction time, t_r, (2 h). Diols with shorter chain length produced smaller ZnO particles. *p*-Toluene sulphonic acid (*p*-TSA) acted as a catalyst and reduced t_r from 8 h to 2 h in concentration of 0.02M. Optimum reaction conditions for the synthesis in ethylene glycol were 185 °C and 2 h. At higher *p*-TSA concentrations (0.04–0.08M) the size of ZnO particles was reduced from 500–800 nm to 50–100 nm and crystallite size to 25-30 nm. Benzene sulphonic acid (BSA) and inorganic bases (LiOH, NaOH, and KOH) also showed catalytic activities. Raman and photoluminescence spectroscopies revealed high concentration of defects on ZnO surface causing the emission of visible light and giving this type of ZnO higher potential in various (opto)-electronic application in comparison to Zn(II) acetate based ZnO.

Keywords: basic zinc carbonate; zinc oxide; diol; nanostructure; catalysis; surface defects

1. INTRODUCTION

Research activities in the field of nanostructured zinc oxide (ZnO) of various morphologies and shapes have witnessed an outstanding expansion in the last 10 years. The scientific interest in nano ZnO is