

# Novel Method of Nanoparticle Synthesis using Surface Grinding

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**Abstract:** Nanoparticles are of most important in all the areas because of their varied and unusual properties. nano particles could be produced using top down and bottom up approaches. We present a novel method of synthesizing nanoparticles such as C, ZnO, Al, Fe<sub>2</sub>O<sub>3</sub>. The surface grinding was taken as a fundamental process inside the proposed Nano Particle Synthesizer (NPS). Parameters such as speed of the grinding wheel, feed rate and coolant feed rate could be used for fixing the dimension and specification of our nano particles synthesizing unit. After Passing through the NPS, particles of micro and nanoparticles were collected in glass plate and characterized using Scanning Electron Microscope (SEM) to confirm the size and shape of nano particles. This method could be employed as an alternative method to High Energy Ball Milling for producing high pressure and high temperature that favors the synthesis of nano particles in specific shape and size.

**Keywords:** nano particle, synthesis, surface grinding, mechanical route.

## I. INTRODUCTION

Nanoparticle production is of high demand, Ball milling is widely used in production of large quantities of nanoparticles [1-3]. Though ball milling technique is extensively studied several other mechanical machining techniques exist that favours the production of nanoparticle. Often mechanical route focus on synthesizing nanoparticles where the size is of prime importance and shape is secondary. Based on the surface grinding operation a Nano Particle Synthesizer (NPS) is fabricated and used for crushing micro sized powder materials to nano size. The resultant samples contain particles with size up to 100nm were observed using Scanning Electron Microscope(SEM). Different materials such as Carbon, Aluminium, Zinc Oxide were taken as coarse particles and converted to nano particles using NPS and their corresponding sizes were analyzed using SEM.

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## II. REVIEW OF LITERATURE

Nanoparticle synthesis using organic [4] and chemical route has been extensively studied. In case of Mechanical route “High energy Ball Milling” and “Mechanical Alloying” were widely employed for synthesis of nanoparticles. Techniques such as Mechanical Exfoliation of graphite into graphene reveal that other mechanical methods need to be given importance.

Carbon nano particle structures such as C<sub>60</sub> and Carbon Nano Tube (CNT) require very high temperature and pressure for producing spherical or cylindrical structure [5]. Such kind of high pressure and temperature could be produced using Surface grinding method within a short span of time. Iron alumina nanocomposite particles were synthesized using ball milling [6].

Similarly ZnO nano particles were synthesized using Reactive Ball Milling [7].

This work focus on other Mechanical machining methods such as surface grinding for synthesis of C, Fe<sub>2</sub>O<sub>3</sub>, Al, ZnO nanoparticle.

## III. EXPERIMENTAL SETUP



Fig. 1 Nano Particle Synthesizer (NPS) Assembly

The above Fig.1 shows the different parts involved in the Assembly of NPS. Electric motor with a speed of 3000 rpm is attached adjacently facing each other and a narrow thin gap of 0.5 to 1mm has been maintained between two grinding wheel as shown in below Fig. 2. Steel frame has been utilized to assemble the motors