



US006620351B2

(12) **United States Patent**  
**Gupta et al.**

(10) **Patent No.:** **US 6,620,351 B2**  
(45) **Date of Patent:** **Sep. 16, 2003**

(54) **METHOD OF FORMING NANOPARTICLES AND MICROPARTICLES OF CONTROLLABLE SIZE USING SUPERCRITICAL FLUIDS WITH ENHANCED MASS TRANSFER**

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(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 119 days.

(21) Appl. No.: **09/858,301**

(22) Filed: **May 16, 2001**

(65) **Prior Publication Data**

US 2002/0000681 A1 Jan. 3, 2002

**Related U.S. Application Data**

(60) Provisional application No. 60/206,644, filed on May 24, 2000.

(51) **Int. Cl.**<sup>7</sup> ..... **B29B 9/00**

(52) **U.S. Cl.** ..... **264/7; 264/9**

(58) **Field of Search** ..... 264/7, 9

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(57) **ABSTRACT**

The current invention, Supercritical Antisolvent Precipitation with Enhanced Mass Transfer (SAS-EM) provides a significantly improved method for the production of nano and micro-particles with a narrow size distribution. The processes of the invention utilize the properties of supercritical fluids and also the principles of vibrational atomization to provide an efficient technique for the effective nanonization or micronization of particles. Like the SAS technique, SAS-EM, also uses a supercritical fluid as the antisolvent, but in the present invention the dispersion jet is deflected by a vibrating surface that atomizes the jet into fine droplets. The vibrating surface also generates a vibrational flow field within the supercritical phase that enhances mass transfer through increased mixing. Sizes of the particles obtained by this technique are easily controlled by changing the vibration intensity of the deflecting surface, which in turn is controlled by adjusting the power input to the vibration source. A major advantage of the SAS-EM technique is that it can be successfully used to obtain nanoparticles of materials that usually yield fibers or large crystals in SAS method. Microencapsulation via coprecipitation of two or more materials can also be achieved using the SAS-EM technique.

**29 Claims, 25 Drawing Sheets**

