

US006001418A

# United States Patent [19]

## DeSimone et al.

4,944,837

[11] Patent Number: 6,001,418

[45] **Date of Patent:** Dec. 14, 1999

[54]		SPIN COATING METHOD AND APPARATUS FOR LIQUID CARBON DIOXIDE SYSTEMS				
[75]	Inventors		ph M. DeSimone, Chapel Hill; en G. Carbonell, Raleigh, both of			
[73]	Assignee	Chap Caro	University of North Carolina at pel Hill, Chapel Hill; North blina State University, Raleigh, of N.C.			
[21]	Appl. No	o.: <b>08/9</b> 9	91,321			
[22]	Filed:	Dec.	16, 1997			
[51]	Int. Cl.6		B05D 3/12			
[52]	U.S. Cl.		<b></b>			
[58]	Field of	Field of Search 427/240, 385.5,				
		427	7/162; 134/18, 22, 33, 133, 85, 137, 157; 118/52			
[56]		Re	eferences Cited			
U.S. PATENT DOCUMENTS						
	4,640,846	2/1987	Kuo 427/82			
			Potter			
			Ikeno et al			

7/1990 Nishikawa et al. ...... 156/646

5,094,892 3/1992 Kayihan ...... 427/440

		Ikeno 427/240
5,392,989	2/1995	Hurtig
5,455,076	10/1995	Lee et al 427/421
5,466,490	11/1995	Glancy et al 427/422
5,472,502	12/1995	Batchelder 118/52
5,496,901	3/1996	DeSimone 526/89
5,591,264	1/1997	Sugimoto et al 118/320
5,665,527	9/1997	Allen et al 430/325

# OTHER PUBLICATIONS

Ober et al.; Imaging Polymers with Supercritical Carbon Dioxide, *Adv. Materials*, 9(13):1039–1043 (1997). (no mo.).

Primary Examiner—Janyce Bell Attorney, Agent, or Firm—Myers Bigel Sibley & Sajovec

#### [57] ABSTRACT

A spin coating method comprises applying a carbon dioxide liquid to surface portion of a substrate; and then rotating the substrate about an axis to distribute the carbon dioxide liquid on the substrate. The carbon dioxide liquid can be distributed on the substrate as a carrier, for the purpose of depositing a material such as a coating on the substrate. In addition, the carbon dioxide liquid can be distributed on the substrate as a solvent, for the purpose of solubilizing, dissolving or removing a material previously deposited on the surface of the substrate. Apparatus for carrying out the present invention is also disclosed.

## 16 Claims, 3 Drawing Sheets