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## Morphological composite materials formed from different precursors

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# United States Patent [19]

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Feger et al.

[45] Date of Patent: **Feb. 22, 1994**

## [54] MORPHOLOGICAL COMPOSITE MATERIALS FORMED FROM DIFFERENT PRECURSORS

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[21] Appl. No.: **647,957**

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[51] Int. Cl.<sup>5</sup> ..... **C08G 69/26; B32B 27/00**

[52] U.S. Cl. .... **528/335; 528/59; 528/67; 528/129; 528/152; 528/159; 528/350; 528/351; 528/353; 526/346; 526/347; 526/347.2; 525/432; 525/481; 525/524; 525/526; 428/413; 428/423.1; 428/429; 428/473.5; 428/500; 264/231; 264/236; 264/331.11**

[58] Field of Search ..... **264/231, 236, 331.11; 528/152, 159, 59, 67, 129, 350, 170, 176, 220, 229, 351, 353, 335; 525/432, 481, 524, 526; 526/346, 347, 347.2; 428/413, 423.1, 429, 500, 473.5**

### [56] References Cited

#### U.S. PATENT DOCUMENTS

3,179,614	4/1965	Edwards	528/125
3,361,589	1/1968	Lindsey	528/125
3,554,935	1/1971	Knapp et al.	521/185
3,620,902	11/1971	Anderson et al.	428/429
3,770,573	11/1973	Dunphy et al.	161/227
3,939,242	2/1976	Lundberg et al.	264/101
4,012,555	3/1977	Keske	428/383
4,051,217	9/1977	Lundberg et al.	264/230
4,107,125	8/1978	Lovejoy	525/183
4,378,400	3/1983	Makino et al.	428/220
4,387,184	6/1983	Coquard et al.	525/183
4,404,317	9/1983	Epstein et al.	524/538
4,477,598	10/1984	Kesting	521/62
4,515,924	5/1985	Brooks et al.	525/432
4,532,316	7/1985	Henn	528/59
5,026,789	6/1991	Weber et al.	525/423
5,244,946	9/1993	Guest et al.	524/86

### OTHER PUBLICATIONS

Polymer Preprints, vol. 31, No. 1, Apr. 1990, pp. 613-615 Moonhor Ree et al. "Polyimide Molecular Composites Via In-Situ Rod Formation".  
Chemical Patents Index, Documentation Abstracts Journal, Section Ch, Week 8923 Aug. 2, 1989, & JP-A-1 110 535 Apr. 27, 1989 & Patent Abstracts of Japan vol. 13, No. 331 (C-622) Jul 25, 1989.

(List continued on next page.)

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### [57] ABSTRACT

A method of producing a multiphase polymer is disclosed whereby the phases have the same chemical structure but have different morphological states and thus different properties. This is achieved by forming a mixture of precursors of the polymer, at least one of the precursors having a reaction rate higher than the other precursor or precursors in the mixture. The precursor having the highest reaction rate is then converted to obtain a composite of a polymer and the precursors that are not polymerized. This mixture might also be formed by mixing a soluble polymer with its precursor. The polymer/precursor composite is processed to obtain the structure having different morphological states by either choosing the reaction conditions to convert the unconverted different morphological states by either choosing the reaction conditions to convert the unconverted precursors such that the obtained polymer differs in its morphology/ properties from the first obtained polymer or by applying stress to the composite and then converting the still unreacted precursor or precursors in the composite such that different morphological states are obtained.

33 Claims, No Drawings