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[54] **FILM FORMING METHODS**

8-17817 1/1996 Japan .
9-220505 8/1997 Japan .

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[57] **ABSTRACT**

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There is provided a spin coating process of forming a coating film through spin coating of a solution on a substrate, wherein periphery portions of the coating film are removed. The film forming method comprises the steps of: (a) initiating dropwise dispensing of a first solvent having a relatively low affinity for the coating film at a position slightly insider a periphery of the substrate covered by the coating film; (b) initiating dropwise dispensing of a second solvent having a relatively high affinity for the coating film at a position closer to the periphery of the substrate as compared to the position of the dropwise dispensing of the first solvent, where the dropwise dispensing of the second solvent is initiated simultaneous to or after the initiation of the dropwise dispensing of the first solvent; (c) stopping the dropwise dispensing of the first solvent; and (d) stopping the dropwise dispensing of the second solvent after stopping the dropwise dispensing of the first solvent.

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[30] **Foreign Application Priority Data**

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[52] U.S. Cl. **438/694**; 438/748; 438/756;
216/91; 216/97; 427/240; 118/252

[58] Field of Search 427/240; 118/52;
216/91, 97; 438/748, 756, 694; 430/329

[56] **References Cited**

U.S. PATENT DOCUMENTS

5,779,928 7/1998 Yamashita et al. 216/92

FOREIGN PATENT DOCUMENTS

6-168872 6/1994 Japan .

20 Claims, 5 Drawing Sheets

