

# EXHIBIT 13



US006645702B1

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

(10) **Patent No.:** US **6,645,702 B1**  
 (45) **Date of Patent:** \***Nov. 11, 2003**

(54) **TREAT RESIST SURFACE TO PREVENT PATTERN COLLAPSE**

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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 99 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **10/050,438**

(22) Filed: **Jan. 16, 2002**

**Related U.S. Application Data**

(63) Continuation-in-part of application No. 09/565,691, filed on May 1, 2000.

(51) **Int. Cl.**<sup>7</sup> ..... **G03F 7/00**

(52) **U.S. Cl.** ..... **430/313; 430/296; 430/328**

(58) **Field of Search** ..... **430/296, 311, 430/313, 315, 323, 324, 325, 328**

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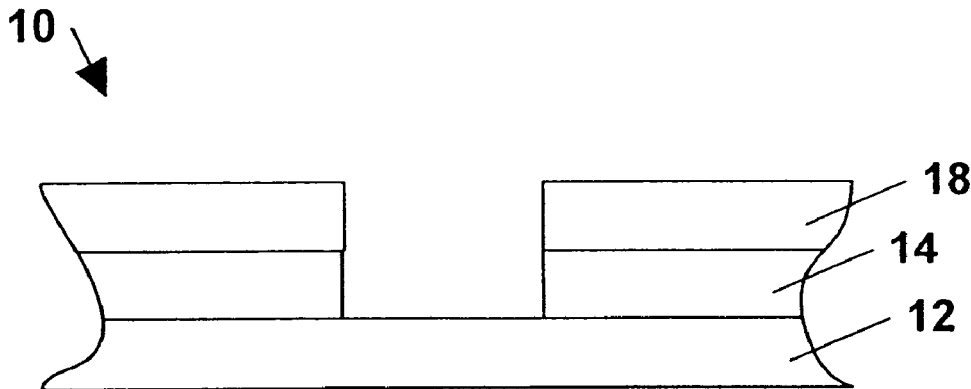
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(57) **ABSTRACT**

The present invention relates to systems and methods for increasing the hydrophobicity of patterned resists. In one embodiment, the present invention relates to a method of processing an ultra-thin resist, involving depositing the ultra-thin photoresist over a semiconductor substrate; irradiating the ultra-thin resist with electromagnetic radiation; developing the ultra-thin resist with a developer to form a patterned resist, the patterned resist having a surface with a first hydrophobicity; contacting the patterned resist with a transition solvent to provide the surface of the patterned resist with a second hydrophobicity, wherein the second hydrophobicity is greater than the first hydrophobicity and contact of the patterned resist with the transition is conducted between developing the ultra-thin resist and rinsing patterned resist; and rinsing the patterned resist having the second hydrophobicity with an aqueous solution.

**22 Claims, 4 Drawing Sheets**



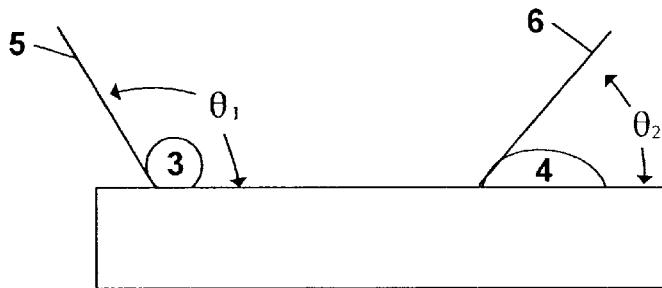


FIG. 1

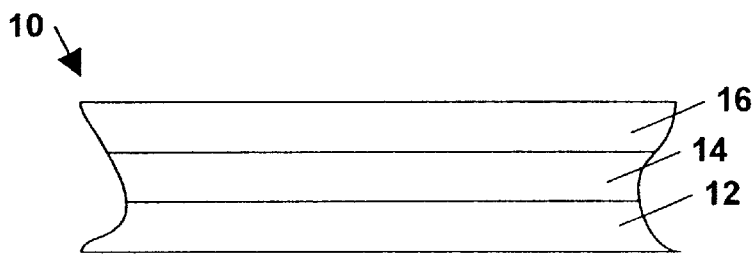


FIG. 2

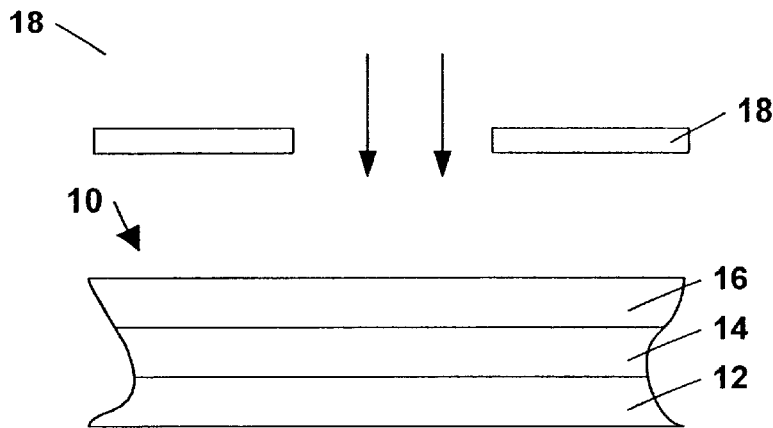


FIG. 3

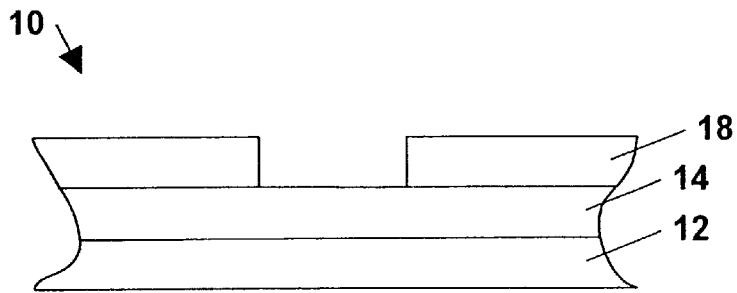


FIG. 4

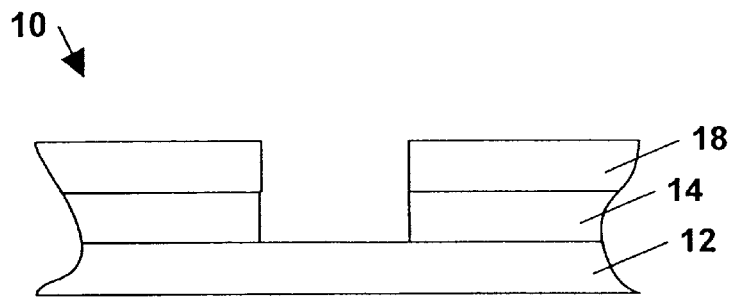


FIG. 5

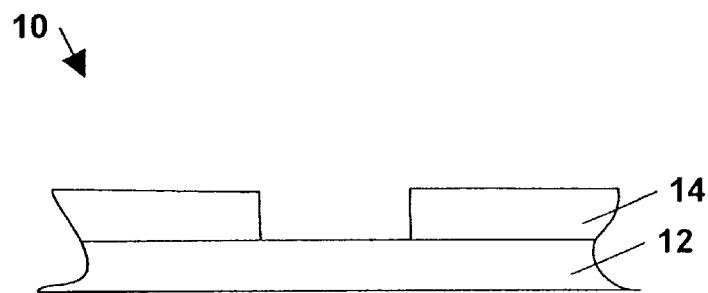


FIG. 6

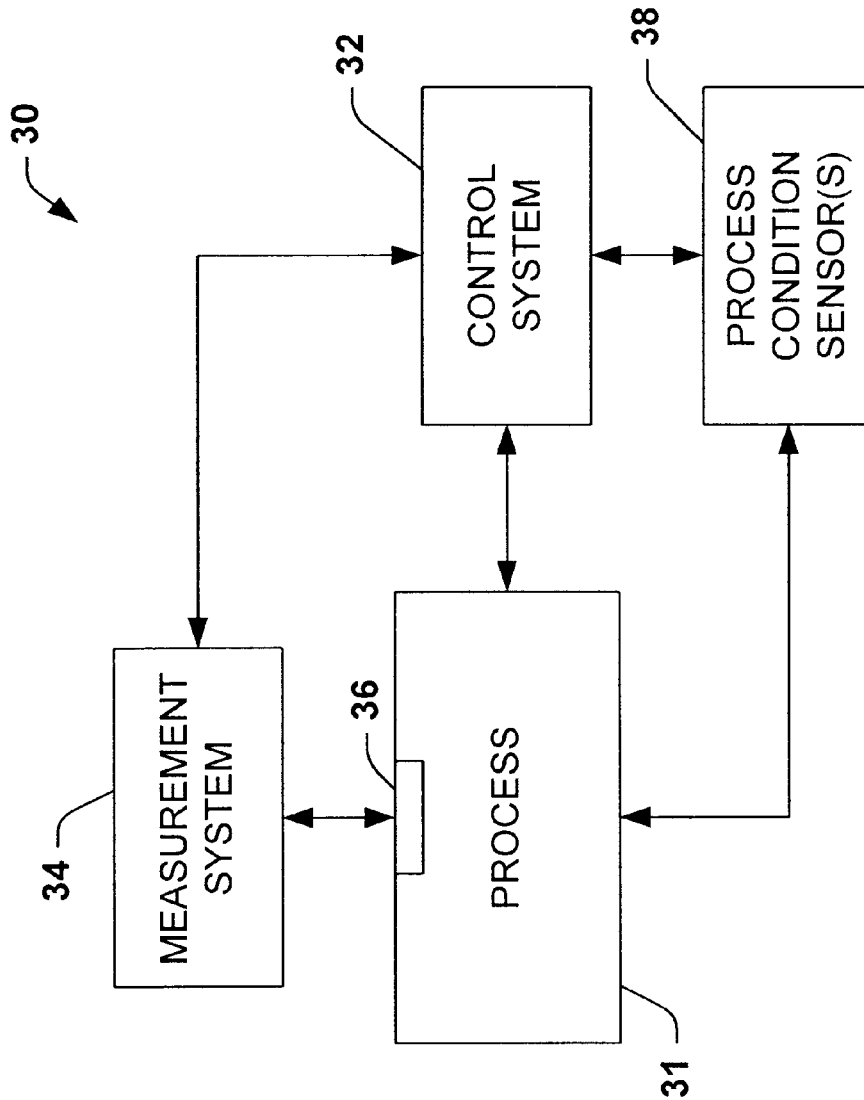


FIG. 7

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