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(12) **United States Patent**
Hajduk et al.(10) **Patent No.:** **US 6,936,471 B2**
(45) **Date of Patent:** **Aug. 30, 2005**(54) **INSTRUMENT FOR HIGH THROUGHPUT MEASUREMENT OF MATERIAL PHYSICAL PROPERTIES AND METHOD OF USING SAME**(75) Inventors: **Damian Hajduk**, San Jose, CA (US); **Eric Carlson**, Palo Alto, CA (US); **J. Christopher Freitag**, Santa Clara, CA (US); **Oleg Kolosov**, Cupertino, CA (US); **James R. Engstrom**, Ithaca, NY (US); **Adam Safir**, Berkeley, CA (US); **Ravi Srinivasan**, Mountain View, CA (US); **Leonid Matsiev**, San Jose, CA (US)(73) Assignee: **Symyx Technologies, Inc.**, Santa Clara, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 440 days.

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Related U.S. Application Data

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(51) **Int. Cl.**⁷ **G01N 31/00**; G01N 3/00; G01N 3/08(52) **U.S. Cl.** **436/2**; 436/55; 435/DIG. 1; 435/DIG. 2; 435/DIG. 9; 73/760; 73/788; 73/789; 73/826; 73/841; 73/847(58) **Field of Search** 435/7.1, DIG. 1, 435/2, DIG. 9; 436/2, 55; 73/760, 788, 789, 826, 841, 847(56) **References Cited**

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(57) **ABSTRACT**

An apparatus and method for screening combinatorial libraries of materials by measuring the response of individual library members to mechanical perturbations is described. The apparatus generally includes a sample holder for containing the library members, an array of probes for mechanically perturbing individual library members, and an array of sensors for measuring the response of each of the library members to the mechanical perturbations. Library members undergoing screening make up a sample array, and individual library members constitute elements of the sample array that are confined to specific locations on the sample holder. During screening, the apparatus mechanically perturbs individual library members by displacing the sample array (sample holder) and the array of probes. Typically, all of the elements of the sample array are perturbed simultaneously, but the apparatus also can also perturb individual or groups of sample array elements sequentially. The flexible apparatus and method can screen libraries of materials based on many different bulk physical properties, including Young's modulus (flexure, uniaxial extension, biaxial compression, and shear); hardness (indentation), failure (stress and strain at failure, toughness), adhesion (tack, loop tack), and flow (viscosity, melt flow indexing, and rheology), among others.

8 Claims, 15 Drawing Sheets