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[54] **METHOD FOR OPTICAL MONITORING IN MATERIALS FABRICATION**

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[58] **Field of Search** .... 29/574; 427/8-10, 427/86, 99, 85, 88, 91, 93-95, 248.1; 156/601, 626, 627; 204/192 SP; 324/71 R, 71 SN; 430/30, 311

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[57] **ABSTRACT**

It has been found that the dielectric function $\epsilon(\nu)$ of materials is strongly dependent on the microstructure of the material, i.e., on the volume fractions that are crystalline, amorphous, and void, respectively. This sensitivity makes it possible to conveniently and nondestructively determine by optical methods, typically a form of spectroscopic ellipsometry, the microstructure of layers of material that are typically bounded by a free surface. The determination of actual volume fractions is made by fitting the result of a model calculation, typically in an effective medium approximation, to the measured dielectric function over an appropriate range of frequencies, e.g. frequencies corresponding to photon energies of approximately 1.5 eV-6 eV. Alternatively, the measured dielectric function, or selected features or functions thereof, can be compared to preselected standard values. In either case, if this is done in a manufacturing context then the information derived allows appropriate adjustment of some manufacturing parameter or step. This can for instance be done by means of in situ monitoring and feedback, or by means of measurements after completion of the deposition of the material, resulting in the ability to tailor subsequent processing steps to the actually existing material state. The method is applicable to dielectrics, doped and undoped semiconductors, and to metals.

20 Claims, 9 Drawing Figures