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# United States Patent [19]

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Dutta et al.

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[54] **CONSTANT-DEPTH SCRATCH TEST FOR THE QUANTIFICATION OF INTERFACIAL SHEAR STRENGTH AT FILM-SUBSTRATE INTERFACES**

4,878,114	10/1989	Huynh et al. ....	358/106
4,934,185	6/1990	Nishiyama et al. ....	73/150 A
5,255,562	10/1993	Yamamoto et al. ....	73/160
5,283,642	2/1994	Sarr .....	73/105

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### [57] ABSTRACT

[21] Appl. No.: **422,725**

A Constant-Depth Scratch Test (CDST) technique to quantitatively determine the shear strength of interfaces between thin metallic or non-metallic films and metal or ceramic substrates is revealed. The test overcomes two problems associated with other types of scratch tests, namely the instrumental complexity required for real-time detection of interfacial failure, and the inability to quantify interfacial strength. These problems are circumvented by maintaining a constant depth during scratching through the coating and the substrate, monitoring the horizontal and vertical forces to sustain the constant depth scratch, and finally by using a model to analyze the test results to quantify the interfacial shear strength. Unlike other scratch tests, this test is capable of measuring interfacial shear strength as a function of position on the film-substrate sample.

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[51] Int. Cl.<sup>6</sup> ..... **G01N 3/34**

[52] U.S. Cl. .... **73/150 A; 73/81; 73/866**

[58] Field of Search ..... **73/866, 838, 841, 73/842, 81, 150 A, 159, 160, 104, 105, 79**

### [56] References Cited

#### U.S. PATENT DOCUMENTS

4,606,225	8/1986	Thomason et al. ....	73/150 A
4,853,777	8/1989	Hupp .....	358/107
4,856,326	8/1989	Tsukamoto .....	73/150 A

**3 Claims, 8 Drawing Sheets**

