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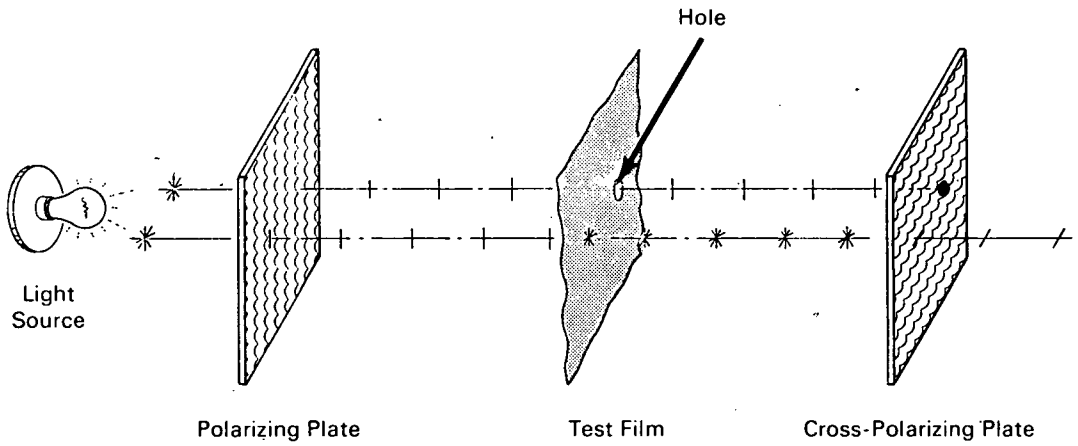
NASA TECH BRIEF

A Method for the Visual Detection of Holes in Thin Polymeric Films



Schematic of Test Apparatus

The use of thin polymeric films for the containment of liquids and gases has necessitated the development of inspection methods for detecting, locating, and evaluating small holes and tears in the films. Such flaws can be detected by the leakage of a pressurizing gas applied to an edge-sealed film structure mounted in an assembly or a test fixture. This method, however, cannot be used on disassembled structures or unsupported films. Consequently, visual inspection must be used for determining the size and nature of the flaws. The latter factor is particularly important as a basis for ascertaining probable causes of failure when testing films of different composition or configuration.

Since thin films of the commonly used polymers (i.e., polyesters, polyimides, polyethylenes, fluorocarbons) are highly transparent to visible light, the detection of a hole with the unaided eye is very difficult and time-consuming under standard lighting conditions. There is no contrast between the light which has passed through or been reflected from the film and the light which has passed through the hole. A method was therefore developed to provide the required visual contrast between the hole and the transparent film. The section of film being inspected is back-lighted with polarized light from a polarizing plate and viewed through a second plate cross-polarized to the back-lighting. The dispersion, refraction, and stress-optic rotation of the polarized light as it passes through the film renders intact film areas visible when viewed through the cross-polarized plate. The polarized light which passes through a hole in the film appears as a black area when viewed through the cross-polarized plate. (Polarized sunglasses are an effective substitute for the second polarizing plate when inspecting large areas of film.)

The major optical effects which render different films visible vary with the base polymers and molecular orientations of the films. Stretch-oriented films

(continued overleaf)

such as polyester and polyimide films show a high degree of birefringence effects and appear in rainbow hues, particularly when the films are wrinkled. Thermoplastic films such as polyethylene, polypropylene, and FEP fluorocarbon are visible as a uniform gray color. Holes always show as black areas in the colored background of the film.

Note:

No additional documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer
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Patent status:

No patent action is contemplated by NASA.

Source: K. E. Wiedekamp and A. D. Von Volkli of
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