

Standard Test Method for Surface Wettability and Absorbency of Sheeted Materials Using an Automated Contact Angle Tester¹

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INTRODUCTION

The property of a liquid to adhere to, or “wet”, a sheeted surface, or to be absorbed by that surface, or both, is important in many aspects of paper manufacturing and converting, as well as in the end-use applications of many converted paper products.

Examples include, but are not limited to, the absorption of water or other liquid by an absorbent structure (such as an absorbent tissue or wipe); the adhesion of an ink to a polymer film or a coated or uncoated paper (such as a packaging or wrapping material); the adherence of a polymer film or sizing material to a paper substrate in a laminate or coated structure; the adhesion of a pressure sensitive tape to a release paper; the adhesion of a film to a paper substrate in a composite structure (such as a diaper or other composite structure); and the non-wetting or non-absorbency, or both, of a barrier paper.

The wetting or sorptive behavior between a liquid and a particular sheeted substrate is dependent, at least in part, upon the relationship of the surface energy (tension) of the liquid and the surface energy of the substrate. The theoretical relationship of these energies is complex, and the different mathematical models which have been proposed for adhesion, wettability, and sorption are beyond the scope of this test method, but may be found in standard texts in these areas. In many cases, however, the contact angle of the fluid which will be in contact with the substrate, or the contact angle of a liquid of known surface tension, when placed in contact with a substrate of interest, is used to understand or predict in-process or end-use results of a particular printing, adhesion, or sorptive application.

Contact angle measurements as described in Test Method D724 or Canadian Pulp and Paper Association CPPAF.3H have been used to study and define the printability relationship between an (aqueous) ink and a paper at the water/paper interface. TAPPIT 552 and Test Method D2578 use a somewhat different, semi-quantitative approach to provide information regarding the energy relationship between a polymer film and a nonaqueous liquid, the test end-point being the place where the contact angle between a liquid of known surface tension and the test specimen approaches zero under the conditions of the test.

The procedure presented in this test method is a simple, completely automated approach to contact angle measurement applicable to a wide range of sheeted materials and liquids where interfacial contact angles range from near zero to near 180 degrees. The automated procedure shows increased precision and greater ease in use than manual procedures.

1. Scope

1.1 This test method measures the contact angle of a test liquid in contact with a flat specimen of a film or a paper substrate under specified test conditions. This test method may

be used with any liquid of interest which is compatible with the equipment used, particularly with regard to liquid viscosity, tackiness, and vapor pressure (evaporation). This test method may be used with any substrate of interest, which can be cut to dimensions compatible with the equipment used.

1.2 For materials which sorb the test liquid under the specified test conditions, the rate of change of the contact angle as a function of time may be significant, and may be determined using procedures described in this test method. It is also possible to evaluate the sorptive properties of a surface, as the

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