Surface Free Energy Analysis of Gelatin Samples

Contact angle measurement can provide useful information about the wetting characteristics of a surface and a liquid. Further, by using different probe liquids with known polar, non-polar, hydrogen-bond energy components, the surface free energy of a solid surface can be determined through contact angle measurement. Surface free energy is the excessive energy existing on the surface of a solid due to imbalanced intermolecular forces among molecules of the solid. The surface free energy provides a more general characterization of a surface chemically and energetically and its analysis is of significance to numerous applications such as wetting, cleaning, contamination, adhesion, friction, lubrication, and wear. For instance, with measured surface free energy values for any pair of solids or solid and liquid the work of adhesion between the two can be analyzed through the Young-Dupré theory.

Table 1 Surface Free Energy of Two Gelatin Samples.

Theory of Energy Analysis			Kaelble-Uy			Wu			Owens-Wendt		
Specimen	C.A. (deg)		S.F.E (mJ/m^2)			S.F.E. (mJ/m^2)			S.F.E.(mJ/m^2)		
	Water	Methylene Iodide	d	p	Total	d	p	Total	d	h	Total
Gelatin 1	87.5	57.5	26.9	3.7	30.6	24.5	8.6	33.1	27.5	3.6	31.1
Gelatin 2	73.3	59.5	22.5	12.0	34.5	21.3	16.7	38.0	24.0	11.3	35.3

d = dispersion component, p = polar component, h = hydrogen-bond component

Table 1 presents the surface free energy analysis performed on two gelatin samples using the Kyowa contact angle meters equipped in our lab. Kyowa Interface Science's contact angle measurement analysis software, FAMAS, supports five popular surface free energy analysis models. These models include Fowkes' acid-base, Kitazaki-Hata, Owens-Wendt, Kaelble-Uy, and Wu Model. Each of the five models determines the same or different components that comprise the total surface free energy. As shown in Table 1, the Kaelble-Uy, Wu and Owens-Wendt models determine the values for each of the components. Because each model has its own assumptions and limitations there is not one that can be universally applicable to all surfaces and probe liquids. Sometimes a particular model will yield useful data and other times it will not based on the combination of solids and probe liquids chosen. In spite of that scientists and engineers may need to work with more than one model, surface energy analysis through contact angle measurement remains a favorite and popular choice for its component level analysis capability and easy of operation.

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