Dispersions of Ink-Jet Pigments: Using NMR Relaxation Measurements as a Quality Control tool

The application performance of any pigment is determined by its nature (including how it was manufactured) and the level of dispersion achieved in formulation. The most important physical properties include particle size and wetted surface area. The finer the size, the more intense will be the color; the greater the surface area, the greater will be the extent and uniformity of surface coating.

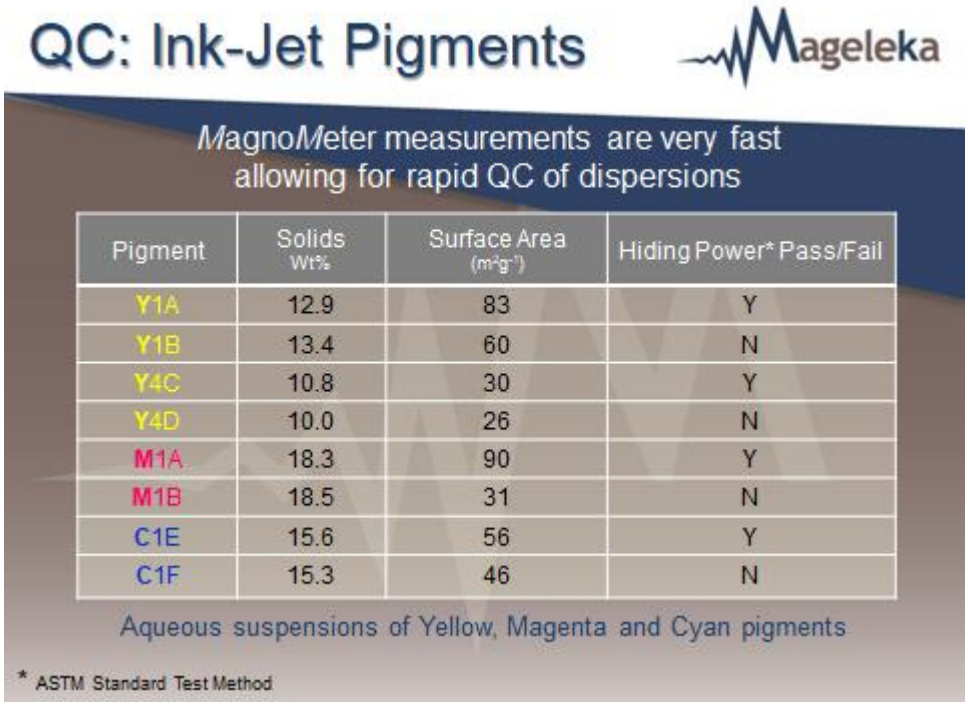
All dry powders will initially comprise primary particles, aggregates and agglomerates but it is the efficiency of the dispersion process that determines the final particle size distribution and, hence, the impact on total wetted surface area. Because high total surface area is important, aggregation in suspensions needs to be kept to a minimum, and any analytical technique that can provide an indication of the degree of aggregation is most welcome. The level of dispersion in any given formulation is, of course, strongly influenced by the mixing equipment and procedures used. However, owing to the opacity and high concentrations normally used precise, accurate physical characterization of nanosize pigment dispersions is often difficult.

The most common method of surface area determination is nitrogen gas adsorption but this technique is useful only for dry powders. It provides no information about the *wetted* surface area of suspensions. Further, it requires extensive sample preparation – for example, a sample must first be degassed – which can be very time consuming. In contrast, the basis for Mageleka *M*agno*M*eter is NMR relaxation. The relaxation time is a fundamental, *intrinsic* property of both solids and liquids and its measurement provides direct information about the extent and nature of *any* particle-liquid interface, i.e., suspensions and emulsions. The *M*agno*M*eter can work with suspensions at any industrially relevant concentration and measurements take only minutes; it is inherently a much simpler technique (see Mageleka Application Note 1).

In the example below, aqueous dispersions of three ink-jet pigments were supplied by a major manufacturer. They were yellow, magenta and cyan and the materials in question were considered to be standards.

Each set were batches had been subjected to the same processing but with different polymeric dispersing aids. Each suspension was tested for hiding power using a procedure adapted from the American Society for Testing of Materials (ASTM) standard method for determining the hiding power of paints.

QC: Ink-Jet Pigments



The data in the table summarizes the surface area values calculated from measurements of NMR relaxation time. As might be expected, the data correlates well with pass/fail criteria for hiding power.

For any suspension, the relaxation time decreases with increase in concentration. In this example, since the percent solids was not quite equivalent for each pigment “pair”, in the calculation of surface area the raw data was normalized with respect to concentration.

The speed and simplicity of measurements with the MagnoMeter make it an ideal tool for routine Quality Control purposes.