

Using a Magnometer to help Choose the correct Dispersing Aid for Silver Metal

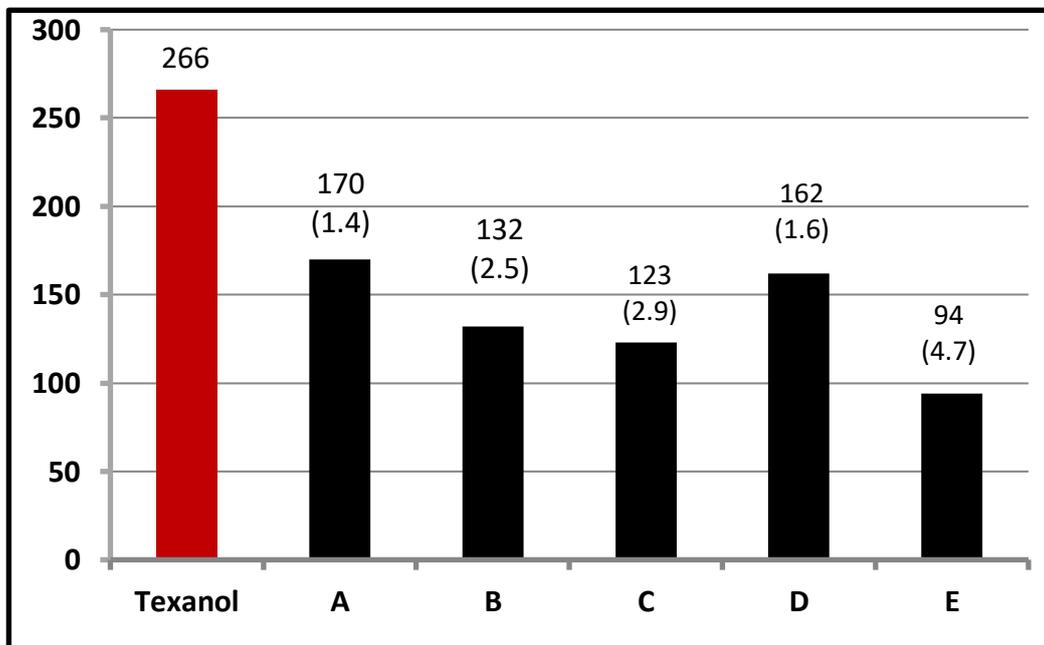
Silver has the highest electrical and heat conductivity of all metals and the lowest contact resistance; silver powders and flakes are widely used to meet the demands of the photovoltaic, electronic, automotive, industrial and medical industries.

Its applications include conductive adhesives, inks and paints. It is of the utmost importance in photography (where approximately 30% of the U.S. Industrial consumption goes into this application). It is used in the making of solder and brazing alloys and electrical contacts, and nano-silver particles can be found in FDA-approved wound dressings.

However, silver, like many metals, can oxidize/tarnish and this alters the particle surface chemistry which, in turn, impacts any dispersion process and, hence, the choice of the most appropriate dispersing agent.

The technique used in the Magnometer measurements is NMR relaxation. Here we show the results of measurements on 60 wt% suspensions of Silver Flake in a non-aqueous vehicle (Texanol – an ester alcohol widely used in coatings applications). A variety of different dispersants were used (at 2wt%) and the relaxation times were compared. The figures in parenthesis are the values of the wetted surface area estimated from the relaxation data.

Figure 1: Comparison of Relaxation times (ms)



Average Relaxation time reproducibility: <	A: No dispersant	B: Zephyrym PD 2206
	C: Hypermer B210	D: Crodafos M915A
	E: Hypermer KD1	

The shortest T_2 time - 94ms - (which results in the largest wetted surface area) was found for the Hypermer KD1-based suspension (Sample E), while the longest T_2 time - 162ms - was found for the Crodafos M915A-based suspension (Sample D). Thus, for this silver flake material, the former dispersant is demonstrably the more efficient. Indeed, the latter dispersant performs only marginally better than using no dispersant (Sample A). This is not unexpected since the CrodafosM915A is an alkylphosphate anionic dispersant more suited to aqueous systems as compared with the Hypermer KD1, a polyester/polyamine co-polymer that is a well-recognized non-aqueous dispersant.

The Zephyr PD 2206 (Sample B) and the Hypermer B210 (Sample C) are both polyhydroxystearicacid/PEG type copolymers and their dispersant performance is intermediate, with the Hypermer B210 being the marginally better of the two.

The Mageleka Magnometer HRS can be used to rapidly fingerprint preparation of suspensions using different wetting agents /dispersants and so aid in both understanding the creation of such suspensions as well as formulation development. Further, the measurement is fast and requires no specialized training making it ideal tool for formulators to compare/contrast lots/batches of metal powders.