OPTIMIZE THE COMPATIBILITY BETWEEN GRAPHENE AND TiO_2 PARTICLES USING THE HANSEN APPROACH

APPLICATION TO THE PAINT & INK INDUSTRY

Context

Formulating stable particle suspensions is of great interest for industrials as it allows to enhance the properties and the lifetime of their products. This is particularly true for the Paint & Inks products in which complex additives can be added to the initial formulation to reinforce define properties. One current tendency for such products is the addition of Graphene which allows to reinforce among others, their anticorrosion and thermal-resistance properties. However, single and few-layers Graphene can present quite important aggregation behavior due to π-stacking as well as destabilizing the formulated product after addition. One way to reduce the additive impact on the product stability is to play on the choice of the dispersion medium, which is often a key parameter to avoid particle agglomeration when adding additives. Indeed, using a solvent which ensures a good Graphene stability and which is compatible also with the initial paint formulation can greatly tackle destabilization. Finding such appropriate solvent is not an easy task as it depends both on the Graphene used and the initial paint formulation. In that way, methods have been already developed to predict this dispersion medium such as the Hansen Parameters (HP).

The aim of this note is to demonstrate that accurate compatibilization of Graphene in a model paint formulation (dispersion of Titanium dioxide TiO_2 P25 in various aqueous mixtures) can be realized by applying the Hansen theory.

Definiton

The semi-empirical Hansen's approach, which has been historically developed to predict the solubility of molecules, can be adapted to describe the particles stability in various solvents. This approach is based on the decomposition of the Hildebrand parameter δ, linked to the binding energy between two particles, into three different parameters δ_D, δ_P and δ_H describing respectively non-polar, polar and hydrogen interactions between the particle surface and the dispersion media as follow: