Cardenas Diego, MESc, “Characterization of Ultrafine Powder Coating Formulations”, The University of Western Ontario, August 2007.

Abstract:

The change in weather trends in the past decades and knowledge of its causes has made society conscious about the damage being done to the environment. This has led to the implementation of tighter regulations to further reduce the amount of VOC emissions released into the atmosphere. Since there are no organic solvents involved in the manufacturing, application and curing of Powder Coatings; they have emerged as an environmentally friendly alternative to solvent based coatings. Moreover, powder coatings can be recovered and reapplied without any material loss compared to 30% to 70% loss from oversprayed liquid coatings. However, 80% of the paints market is still liquid simply because of the disadvantages of current powder such as thicker and rougher finishes.

Ultrafine powder coatings can solve many of the above these problems taking advantage of new advances in the manipulation and fluidization of ultrafine particles to overcome the strong interparticle forces. This will allow ultrafine coatings to increase their market share in applications where Class A finishes are required. Ultrafine powder coatings with an average particle size of 10 to 20 microns improve the appearance, physical-mechanical properties and performance shown by regular size paints of 30 to 60 microns and at the same time, it decreases the amount of powder applied with savings of up to 50% in material usage. This project focuses on new characterization and evaluation of physical and mechanical properties, as well as the performance of ultrafine powder coatings. It also compares the properties of formulations with Alumina Trihydrate against those with Barium Sulfate when used as functional fillers for medium gloss finishes.

It was found that ultrafine powder coatings have several advantages over their regular size counterparts, by providing lower values of Angle of Repose and higher Bed Expansion Ratios, which indicates better fluidization properties. The mechanical properties exhibited by ultrafine powder coatings were also better with improved flexibility and impact resistance associated with the thinner finish. Although the incorporation of fillers slightly affected the flexibility of the coating, it provided excellent scratch hardness. Additionally, it was determined that epoxy and hybrid based powder coatings are the most suitable for applications in corrosive environments but not under outdoor conditions. Conversely, polyester and polyurethane based powder paints exhibited the best performance under outdoor conditions with gloss retentions around 50% after 1000 hours of accelerated weather exposure. Finally, it was determined that $Al(OH)_3$ is a good alternative to produce low gloss finishes as low as 30 @ 60° in one shot.