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COMPARATIVE EFFECT ON CONSTANT AND PULSED VOLTAGE APPLICATION IN ELECTROPHORETIC DEPOSITION OF SUBMICRON POLYSTYRENE LATEX (PSL) PARTICLES

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ABSTRACT

Electrophoretic mobility of polystyrene latex (PSL) particles in aqueous are influenced and interfered by gas formation during electrolysis when electric field is applied. Aqueous electrophoretic deposition (EPD) yields numerous advantages, however, it has several unsolved challenges such as particles aggregation, affecting the uniformity of the deposited layer. This thesis presents a conclusive study investigating both of electrolysis and EPD process. Firstly, the thesis studies the fundamental aspect of EPD in aqueous, which is the volume of bubbles formation during electrolysis under pulsed and continuous DC charging is investigated. Secondly, the effects of both charging method on the electrophoretic mobility of deposit particles and bubbles growth is investigated. Three different sizes of polystyrene latex (PSL); 600 nm, 300 nm and 100 nm were used in this experiment. During the study, the particles electrophoretic mobility and the gasses influences were recorded using the microscope when pulsed and continuous DC charging was applied. It was observed that the particles mobility was more uniform and indicates sharper distribution when pulsed DC charging was applied compared to continuous DC charging. This indicates that pulsed DC charging is an effective method to produce uniform particles deposition in comparison to continuous DC charging method. It was also found that the variation of particles velocity was attributable to large quantity of bubbles produced during the EPD interrupted the particles movements. Application of pulsed DC yielded a narrower distribution of particle velocity, ascribed to the lower quantity of bubbles. High velocity particles provides better momentum to resist the bubbles interferences. During the deposition, gas formation due to electrolysis was also successfully quantified via observation by microscope. It was found that bubbles growth was significantly reduced when pulsed DC is applied which minimal the particles mobility interference when migrating towards the electrode vicinity. It was also noticed that by increasing the velocity of the particles and minimizing the gas formation contributes to uniform particle deposition.

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