

Development of a Low Cost, Static Light Scattering based Nano-Particle Size Analyzer

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A machine based on Static Light Scattering theories was developed for the cost effective and efficient Quality Control of the average particle size of nano-particles used in different manufacturing industries. In particular the instrument was adapted to measurement of carbon black filler used in rubber compounding. Carbon blacks are amorphous quasi graphitic particulates of the nanometer scale whose mean particle size affects the reinforcement, conductivity pigmentation and UV resistance properties of the rubber. The instrument would enable local rubber compounding companies to independently monitor and control the average particle size of the filler.

The system is semi-autonomous and measures approximately 29cm × 23cm × 17.5cm and weighs approximately 4.2 kg. The instrument accepts a solution of nano-particles. Adjusts the solution concentration automatically and measures the scattered intensity of light which it used to calculate the particle size.

The system comprises of a fluidics module that handles the pumping and dilution of solutions, an optics module that generates and detects the light and a control & power supply module that operates the other components and supplies the right voltages to them. These modules are housed in a corrosion protected steel frame and an aesthetically appealing enclosure.

Key features of the instrument are a self diagnostic system, a modular structure, a graphical user interface with record keeping facility and extendibility to other particle size control applications. It is of a modular design and has been constructed with the ease of maintenance and accessibility to internal hardware, and manufacturability in mind. The components selection was based on the optimization of performance parameter, size and cost. Mechanical, thermal and vibration stabilities were considered in the design.