EFFECTS OF INTERLAYER PROPERTIES ON PERFORMANCE OF COALESCING FILTERS

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Impurities such as aerosols in air are harmful to human health and the environment. Impurities can also be harmful to industrial operations. Coalescing filters are effectively used to purify gas streams by removing micron and submicron sizes drops. The performance of coalescing filters is evaluated by capture efficiency, pressure drop and quality factor, and depends upon several parameters including permeability, porosity, wettability of filter media.

The current work aims at developing a model to simulate the behavior of oil droplets across filter layers with gradient of capillary force. In this work, the filter media are composed of five thin layers of glass fiber treated by silanes to achieve different wetting properties using CVD (chemical vapor deposition). When a liquid aerosol flows through a filter medium, there are three possible scenarios to describe the movements of oil drops: i) the drops tend to be retained in the oil-wetting layer; ii) the drops concentrate at the interface between layers; or iii) the drops pass through media without resistance. An approach to quantify the effects of interfaces is to measure the saturation of oil in each filter layer at the end of the experiments. Experiments were run to compare the effects of differences in properties between the layers such as fiber diameters and surface wettability. Experimental results are compared with a tentative model to predict and compare performances of filter designs.