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PM2.5 Separation Efficiency and Energy Assessment for Cleanable Oil-Water Soluble Mist – and Dust Filter Media

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Cleanable filter media work with alternating filtration and regeneration cycles, where the filtration behavior changes from the very beginning over time until nearly a stationary state has been reached. Besides cleanable baghouse dust filter media, also oil-water soluble coolant mist filters can be referred to cleanable filters. In this case the cleaning part can be seen as the drainage flow, which partly discharges the separated and coalesced liquid droplets. The drainage flow changes also with time up to a certain stationary state, when it reaches nearly the separated droplet mass flow. The assessment of cleanable filter media is usually carried out during this stationary state, which is reached after an aging period. As test equipment already known test rigs of relevant standards can be used. For cleanable dust filter media, this is the VDI 3926:2004 guideline and ISO 11057:2011 standard /1/. For oil-water coolant mist filter media also a new standard exists, which includes also an aging procedure (OENORM Z1263 /2/). The measurement of the pollutant separation efficiency focuses only on the oily part in the oilwater mixed droplet, which is relevant for legislative limit values, and which cannot be evaluated by a sole droplet size measurement. Further the test rig includes also a special oil-water droplet generator, which ensures reproducible, sufficient high oil-water droplet concentrations, usually found in real machining processes. Several test runs with different oil-water soluble coolant mist filter media and cleanable dust filter media, using the two test equipment as described in /1/ and /2/, were done. From those results a filter media assessment can be worked out by using a quality factor. A so-called PM2.5 quality factor is then calculated from the measured PM2.5 separation efficiency and the energy consumption (pressure drop). In case of the cleanable dust filter media, also the consumption of the filter cleaning energy is included.

The relevant model equations for the calculation of the PM2.5 quality factor, will be presented. At the end it will be demonstrated how this PM2.5 quality factor can be used for ranking different oil-water soluble coolant mist filter media and also for cleanable dust filter media