# CONTROLLED MTMS-BASED AEROGEL DEPOSITION ON FIBROUS FILTER FOR OIL MIST SEPARATION IMPROVEMENT

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Air containing dispersed oil phase occurs in machining and cutting operations, engine closed crankcase ventilation and compressed gas cleaning. Significance of this issue stems from the fact that many liquids used in industry are harmful both for humans and other living organisms. Especially droplets in micro and submicron scale, which can penetrate the respiratory system and are particularly difficult to remove. Gas streams purification is widely carried on common fibrous filters, most of which do not meet the gas purification requirements, so the filter modification is requisite. This work focuses on applying sol-gel method into modification of polypropylene fibrous filters, produced by melt-blown technology. Due to the deposition of aerogel structure on filter fibers, new properties are added in order to intensify surface phenomena, thus improves oil filtration efficiency. Methyltrimetoxysilane (MTMS)-based aerogel exhibit hydrophobic and oleophilic properties, as well as good sorptive properties, mainly thanks to high porosity and high specific surface area.

Aerogel is synthesized in two step sol-gel process. MTMS is mixed with solvent (methanol) and water solution of oxalic acid is added dropwise, to promote hydrolysis reaction – acid step. After 24h, ammonium hydroxide is slowly added, where the alkaline medium favors the condensation of silanols, increasing the reaction rate forming a sol and, subsequently, gel – basic step. Filter sample is placed within the reactive solution right after ammonia addition is finished; thus filter fibers are covered by condensing alcogel. After drying sequence, aerogel coating is obtained on the fibers surface.

As it was measured, alcogel gelation occurs at different speed, depending on MTMS:methanol volume ratio. Hence, different distribution of organosilica structure is obtained on the filter. For lower dilution of MTMS gelation occurs faster and more aerogel is deposited on filter surface in form of thick monolith layer. The more diluted MTMS is, the slower gelation occurs and the bigger fraction of aerogel mass is deposited in the filter volume. Also, with higher dilution of MTMS, less amount of aerogel is obtained and its porosity decrease. Such differences affects separation properties of modified material and its pressure drop. That is why controlled deposition of aerogel obtained from more concentrated MTMS is vital. As it will be presented, by simply changing the ammonia solution addition speed, it is possible to influence the gelation rate and thus control aerogel distribution on modified material.

Thanks to described above modification method, fibrous filter was covered with aerogel. With different MTMS:methanol volume ratios, amount of synthesized aerogel was changed. While with different addition speed of ammonia solution, it was possible to control the distribution of aerogel deposition. Influence of modification parameters on filter surface properties, oil sorption capacity, oil mist separation efficiency and pressure drop were examined. General retention of modified filters raised from 20 (for native filter) up to 80% (droplet diameter range 0,02-10μm), while separation efficiency for MPPS increased from 25 to even 60%.

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