

Influence of relative humidity and physical load during storage on dustiness of inorganic nanomaterials: implications for testing and risk assessment - DTU Orbit (08/11/2017)

Influence of relative humidity and physical load during storage on dustiness of inorganic nanomaterials: implications for testing and risk assessment

Dustiness testing using a down-scaled EN15051 rotating drum was used to investigate the effects of storage conditions such as relative humidity and physical loading on the dustiness of five inorganic metal oxide nanostructured powder materials. The tests consisted of measurements of gravimetric respirable dustiness index and particle size distributions. Water uptake of the powders during 7 days of incubation was investigated as an explanatory factor of the changes. Consequences of these varying storage conditions in exposure modelling were tested using the control banding and risk management tool NanoSafer. Drastic material-specific effects on powder respirable dustiness index were observed with the change in TiO₂ from 30 % RH (639 mg/kg) to 50 % RH (1.5 mg/kg). All five tested materials indicate a decreasing dustiness index with relative humidity increasing from 30 to 70 % RH. Test of powder water uptake showed an apparent link with the decreasing dustiness index. Effects of powder compaction appeared more material specific with both increasing and decreasing dustiness indices observed as an effect of compaction. Tests of control banding exposure models using the measured dustiness indices in three different exposure scenarios showed that in two of the tested materials, one 20 % change in RH changed the exposure banding from the lowest level to the highest. The study shows the importance of powder storage conditions prior to tests for classification of material dustiness indices. It also highlights the importance of correct storage information and relative humidity and expansion of the dustiness test conditions specifically, when using dustiness indices as a primary parameter for source strength in exposure assessment.

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