

Effectiveness of risk mitigation strategies on the insurability of nanomanufacturing processes

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The Insurance Sector

- Relevance
- How it works now
- How we would like it to work
- How we can achieve accurate risk assessment?

Hazard identification

1. Critical analysis of the SDS of the nanomaterials, as provided by the company supplying the ENM. The appraisal is based upon the literature resources and guidance documents describing best practices such as that from ISO as well as the Swiss State Secretariat for Economic Affairs
2. Screening of the literature for the development of a practical hazard identification scheme (i.e., the SAS tool).
3. Integration of the above scheme with an efficient (toxicological) testing strategy.

Identifying structural determinants of Hazard

1. Is the median particle size in the upper or lower portion of the 100nm size range?
2. Is the bulk material classified as carcinogenic, mutagenic, or toxic for reproduction (CMR) or sensitizer?
3. Is the nanomaterial reactive? (because: (a) contaminated with reactive contaminants, or (b) intrinsically reactive for the presence of chemical groups or photo-reactive)
4. Is the nanomaterial highly acidic/basic?
5. Does the nanomaterial have a charged surface?
6. Is the nanomaterial soluble?
7. Is the nanomaterial a HARP?

Summary of hazard identification based on structural indicators

Structural Alerts	Zirconium Dioxide		
	<i>Pristine ZrO₂</i>	<i>Citrate coated ZrO₂</i>	<i>P25</i>
<i>Lower or upper portion of 100nm size range</i>			
<i>Bulk is a CMR or sensitizer</i>			
<i>Reactivity</i>			
<i>Acidity/ Basicity</i>			
<i>High Surface Charge</i>			
<i>Solubility</i>			
<i>HARP</i>			

Summary of hazard identification based on structural indicators

Structural Alerts	Titanium Dioxide		
	TiO ₂ nanosol	Silica coated TiO ₂	Citrate coated TiO ₂
<i>Lower or upper portion of 100nm size range</i>			
<i>Bulk is a CMR or sensitizer</i>			
<i>Reactivity</i>			
<i>Acidity/ Basicity</i>			
<i>High Surface Charge</i>			
<i>Solubility</i>			
<i>HARP</i>			

Summary of hazard identification based on structural indicators

Structural Alerts	MWCNT		
	Pristine MWCNT	MW-FG	MW-SD
<i>Lower or upper portion of 100nm size range</i>			
<i>Bulk is a CMR or sensitizer</i>			
<i>Reactivity</i>			
<i>Acidity/ Basicity</i>			
<i>High Surface Charge</i>			
<i>Solubility</i>			
<i>HARP</i>			

Conclusions

1. Physico-chemical data provided by the suppliers (SDS) or from Sanowork
2. each material and its remediated forms were screened using SAS
3. A hazard matrix was compiled
4. Knowledge gaps in terms of physico-chemical characterization
5. Exposure must be managed
6. Implications for insurance and regulators
7. And Cost implications

Bibliography

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- Mullins, M., F. Murphy, L. Baublyte, E. M. McAlea and S. A. M. Tofail (2013). 'The insurability of nanomaterial production risk', Nature Nanotechnology 8(4): Pages 222-224

Thanks & Questions?