Dustiness testing – a concrete outlook

Concrete is one of the most commonly used construction materials in the world. There is continuous research on improving the properties of the material, as concrete structures are often subjected to detrimental processes, such as cold and hot temperatures, corrosive elements or heavy loading. One common method to enhance the strength and durability of concrete is to add fibers to the concrete mix, as they can help prevent cracks spreading in the concrete structures.

One alternative is to use carbon nanotubes for reinforcing the concrete. They are small fiber-shaped particles that have extremely interesting mechanical and electrical properties. However, the carbon nanotubes are small enough to reach the deepest parts of the lung when inhaled and have been linked to similar health hazards as asbestos, another type of fiber material that is infamous for having caused cancer (and other severe pulmonary diseases) when inhaled. Therefore, it is of the utmost importance to study the risks involved with using carbon nanotube-enforced concrete in order to establish proper protection for the people who are most likely to be exposed to the material.

One aspect of this risk analysis is to study the particles that are released from the concrete and become airborne during different common handling processes. One property that can be studied for this purpose is the dustiness of the material, i.e. the tendency for the material to release dust particles into the air. This project studied the dustiness of different concrete types, both with and without added carbon nanotubes. The concrete samples were crushed and then dropped from a height of roughly 1 meter in a controlled environment. The emitted airborne particles were then sampled and characterized in order to estimate how the emissions change, both in between the different concrete types and in between different concentrations of carbon nanotubes.

Three different types of concrete were used: one normal strength concrete, one high performance concrete and one lightweight and porous concrete. The tests showed some interesting results: the presence of carbon nanotubes affected the dustiness levels differently in between the different types of concrete. It seems that the dustiness can either increase or decrease depending on the amounts of added carbon nanotubes in the concrete. Another interesting result was that the lightweight and porous concrete showed the highest dustiness levels and therefore makes it especially interesting with regards to taking proper safety precautions.