Nanotechnology for Fire Protection
By Christopher Huston

Fire protection comes in various methodologies. The most known form is the manual application of water. Which makes sense to the layperson, fire is hot and water cools. However, in the fire service, professionals have a greater understanding of this phenomena. At the molecular level the hydrogen bonds break as they absorb the heat energy of the fire and convert liquid water to steam. For hundreds of years this process was the one of few chemical antidotes for unrestrained fire. In modern times other chemicals have been used to quench the flames. Even now in our ultra-high tech world, chemistry plays a critical role in fire protection. Enter the age of nanotechnology for fire protection.

The rise of nanotechnology - The ability to manipulate particles in microns has been surpassed by the manipulation of nanometer sized particles. Nanometers are on the scale of molecules and atoms. Particles that were only discovered in the last hundred years and undetectable by the human eye, are now being manipulated. Leaps and bounds have been made in this field, even though it is still in its infancy. Many products that are currently on the market contain nanotechnology. Our world is being shaped by technology and can be made safer through educated and responsible use.

Fire Protection and Nanotechnology- Fire protection can benefit greatly from nanotechnology. These advantages do not come in the form of suppression agent, but rather fire protective coatings. Manipulating the surfaces of normally combustible materials by adding a fire resistive coating creates additional fire resistive options for construction, while providing a higher level of fire protection.

Nanotechnology for Fire Protection can already be found. “Considerable opportunities to obtain flame-retardant polymeric materials result from the development of nanotechnology” (Janowska, Kucharska-Jastrzabek, Rybinski, 2011) state the authors of the paper Thermal stability, flammability and fire hazard of butadiene-acrylonitrile rubber nanocomposites. This rubber-like membrane can be applied to normally combustible products and significantly increase their fire resistance.

Nanotechnology greatly enhances the time to ignition by protecting the fuel source. Many of the coatings made of a polymeric can be applied in the same manner as paint; rolled on, sprayed on, or brushed on. The additives dry translucent and are virtually undetectable to the untrained eye, in some cases. The carbon layer that is left insulates the material and limits the amount of thermal energy absorbed from the heat source. Fires spread through conduction, radiation, and convection, mostly all at the same time. Combustion of solid fuels requires that pyrolysis exist. The coatings applied will decrease the combustibles ability to off-gas, thus elongating the time to ignition. Many times these fuels are the structural members of the building itself which causes extreme risk to occupants and fire suppression forces.

Fire Protection Engineers, Firefighters, Code Officials, and scientist need to work together to enhance fire protection measures. Nanotechnology can take these measures to new levels at very little cost. Understanding chemistry and physical science are important to fire protection, and nanotechnology is included.

Reference

Janowska, G., Kucharska-Jastrzabek, A., & Rybinski, P. (2011). *Thermal stability, flammability and fire hazard of butadiene-acrylonitrile rubber nanocomposites*