Large-scale application of nanotechnology for wood protection

To the Editor: A number of recent articles in this journal have commented on the gap between the scientific interest in nanotechnology and its commercial impacts[1,2]. Some commentators have even suggested that failure of nanotechnology to deliver substantial returns on investment will undermine the generous support that the field receives[2,3]. It is surprising, therefore, that the large-scale commercial use of nanoparticles for the biological protection of timber seems to have escaped the attention of many working in the nanotechnology field.

In the past two years, a number of North American chemical companies have commercialized wood preservatives that consist of copper carbonate particles and an organic co-biocide, both dispersed in water[4]. The copper particles, which vary in size from 1 nm to 25 μm, are made by ball-milling an aqueous slurry of copper carbonate and wetting agents[4]. Nanoparticles, some as small as 20 nm in diameter, are abundant in the aqueous preservative, whereas larger particles are more prominent in treated wood where they accumulate on cell walls and within the openings that connect the cellular elements of the wood (Fig. 1).

The market for treated wood in North America is valued at $4.9 billion (gross sales), and each year around 20 million cubic metres of wood are treated with aqueous, mainly copper-based, preservatives[5]. The annual consumption of copper salts for wood protection in North America, which represents 50% of the global market for wood preservatives, is estimated to be 79,000 tonnes[5]. The new nano-copper preservatives compete with treatments that contain dissolved or complexed copper salts, and this year they have captured at least 50% of the North American market, making the seemingly mundane application of wood protection one of the world's largest end uses of nanoparticles.

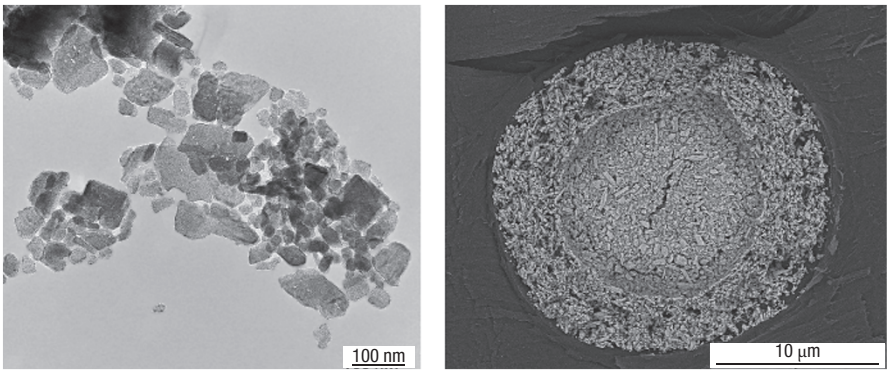

Figure 1 Copper carbonate micro- and nanoparticles in a commercially produced wood preservative (left) and accumulation of larger particles on a membrane within an opening (bordered pit) that connects fibres in treated southern pine wood (right).

Unusually, this large-scale commercial use of nanotechnology for wood protection was not preceded by much interest in the area from the scientific community, despite widespread recognition that nanotechnology has great potential to improve the performance of wood and other cellulosic materials[6]. Some publications are now appearing in the open literature on the new preservative systems[7–9], but the number of scientists working in the field of wood protection is small and they have little experience with nanotechnology. Hence, progress in understanding the properties and mode of action of the new nano-preservative systems has been slow.

We seek through this letter to encourage broader engagement in this field by the nanotechnology community to close the gap more rapidly between the commercial exploitation of the new treatments and the underlying science. This could lead to improvements to the current systems and, perhaps, the development of radically new treatments, which could result in further large-scale use of nanotechnology in the commercially significant building and construction sector.

References

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