

Approaching Nanoscience to the Footwear Sector

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Abstract

The footwear industry is deeply rooted in La Rioja region. From household production of espadrilles to industrial production of footwear today, the shoe industry has been adapting to the continuous market changes, keeping its competitiveness. Nowadays this sector is configured as a driver of the economy of the area. With this aim in mind, the Footwear Technology Center of La Rioja (CTCR) works as a support to the footwear industry by offering the latest technologies and as a promoter of R&D+i. Particularly, the Department of Nanotechnology and New Materials applies the nanoscience principles to the improvement of both products and processes in the footwear sector.

When the particles change from centimeter to nanometer scale, the surface area and the surface energy increase several orders of magnitude, according to the nanoscience principles. In this way, the surface reactions become faster and more efficient. The CTCR has developed a project where the size of the charges of the formulation rubber has been reduced to nanometer scale. This has allowed a reduction of the vulcanization rate up to 40 %, thus increasing the production of outsoles.

The nanoscience also allows designing nanostructures and nanoparticles with desired properties. When the nanoparticles are suspended in a liquid is possible to obtain a nanofluid. Some of these nanofluids present non-newtonian properties, which are useful in various applications. The non-newtonian nanofluid materials are able to harden under the action of an impact and remain fluid in others circumstances. A nanofluid prepared in the CTCR has been included in an urban motorbike boot. This boot is able to absorb up to 90% of the energy of an impact, in order to prevent injuries due to its hardening. Moreover, the nanofluid behaves as a liquid that offers flexibility and comfort.

The surface chemistry of nanomaterials makes possible its modification keeping its intrinsic properties. The CTCR has carried out a project where bactericide nanomaterials have been superficially functionalized to improve compatibility and dispersion within the rubber matrix, with the aim to avoid the bacterial growth in some workplaces.

Nanoporous and microporous materials are accessible by designing nanostructures as zeolites. Nanoporous materials are capable of hosting molecules and nanoparticles inside their pores and in their external surface. In the CTCR, zeolites with special “guest” particles have been included in rubber to get fireproof outsoles with halogen-free compounds.

Summarizing, these depicted cases show how nanotechnology provides great advantages in the footwear industry for the differentiation in the market.