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Fullerene-like Soot in the New Generation EURO-IV Diesel Engines

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The particulate matter (soot) is one of the main adverse components of diesel exhaust gases. It is produced as an unwelcome byproduct during the incomplete fuel combustion and is a serious threat to environment and human health. The development of lower particulate emission engines has been, and still is, the goal of automobile industry in USA and Europe. Recently, we studied the morphology, microstructure and bonding state of soot particles of an optimised EURO-IV diesel engine by means of HRTEM and EELS. The low-emission engine produces carbon particles with an averaged size less than 15 nm. Core-shelled spherical primary particles are found as described in the literature, but more primary particles do not exhibit a defined structure. High-resolution images reveal fullerene-like clusters or molecules on the surface of the primary particles and can be, as polycyclic aromatic hydrocarbons and organic radicals, considered as possible nuclei and source for the formation of soot. EELS reveal the co-existence of sp^2 and sp^3 hybridisation of carbon atoms in soot-particles.