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Core@shell Ag@Ti nanoparticles prepared by in-flight coating

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Heterogeneous nanoparticles (NPs) combine the advantages of the two different materials. Different NPs like Janus, dumbbell, satellite and many others have already been reported. The main attention has been paid to the investigation of core@shell NPs because their optical, electrical, chemical and catalytic properties can be tuned by combining specific core and shell materials.
Titania (TiO2) in a form of anatase is well known for its photocatalytic properties and silver exhibits strong plasmon resonance. In case of Ag@TiO2 NPs those two effects can be combined in a way that the photocatalytic properties of the titania are enhanced due to the SPR-mediated electron transfer from the Ag core to the titania shell.
In the most cases wet chemical methods are used, however, in this study Ag@TiO2 NPs were produced using a fully plasma-based strategy. The Ag NPs as cores, were fabricated in the gas aggregation source (GAS) of Haberland type. These NPs were subsequently in-flight coated by a thin Ti shell in a modification chamber with the two DC magnetrons facing each other with an axis perpendicular to the beam of NPs. Closed and opposing magnetic fields arrangements were tested. Changes in the magnetron current, distance between magnetrons or magnetic field configuration allowed to tune the thickness of the Ti shell. The XPS, EDX, (S)TEM and SAXS analysis confirmed the expected core@shell structure with the shell thickness up to 3.5 nm. According to XPS the Ti shell is fully oxidized and the TiOx oxide is amorphous as witnessed by XRD. The possibility to convert TiOx amorphous shell in the TiO2 anatase will be discussed.
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