P3-9 The Ice Nucleation Activity of Black and Brown Soot Aged by Exposure to NO2 and SO2

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The ice nucleation activity (INA) of soot was studied experimentally. Two different types of soot were produced by burning a propane-air mixture under controlled conditions with a miniCAST (combustion aerosol standard, Jing Ltd) burner. Depending on the mixture proportions of the burner, soot with high and low organic content was obtained. Subsequent reactions of the soot with NO2 and SO2 were carried out in a reaction chamber with exposure times between 30 and 360 minutes. Untreated and treated soot samples were analyzed for their INA in immersion freezing experiments. Their composition was analyzed via X-ray photoelectron spectroscopy; their microstructure was studied via Raman spectroscopy and their morphology was analyzed via transmission electron microscopy. We showed that the INA of soot with a high composition of organic material increased significantly after a reaction with NO2 and SO2. The heterogeneous mean freezing temperature was increased by 10-12 °C to approximately -25 °C. Untreated and NO2-treated black carbon showed no INA, but after 30 minutes of SO2 exposure, the heterogeneous mean freezing temperature shifted by 15 °C to -22 °C. Analytic analyses revealed that the surface composition and the degree of graphitization impact the INA. The interplay among the properties relevant for ice nucleation such as the chemical composition and the microstructure of the soot's surface, which are closely related to each other, is important and needs to be considered when predicting the ice nucleating ability of soot.