Journal of Materials Science

supplementary information for

Atmospheric Pressure Metal Organic Chemical Vapor Deposition of Thin Germanium Films

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XPS of as deposited films

XPS measurements were performed with an ESCALAB 250Xi Xray photoelectron spectrometer microprobe (Thermo Scientific) equipped with a monochromatic Al Kα (hν = 1486.68 eV) X-ray source. A pass energy of 200 eV was used for survey spectra and 20 eV for high-resolution core-level spectra. Spectra deconvolution and quantification were performed using the Avantage Data System (Thermo Scientific). The linearity of the energy scale was calibrated by the positions of the Fermi edge at 0.00 ± 0.05 eV, Au4f7/2 at 83.95 eV, Ag3d5/2 at 368.20 eV, and Cu2p3/2 at 932.60 eV measured on the in situ-cleaned metal surfaces. To prevent charging, the samples were measured with a built-in charge compensation system. Finally, the spectra were corrected to the C1s sp3 peak at 284.8 eV as the common internal standard for BE calibration.

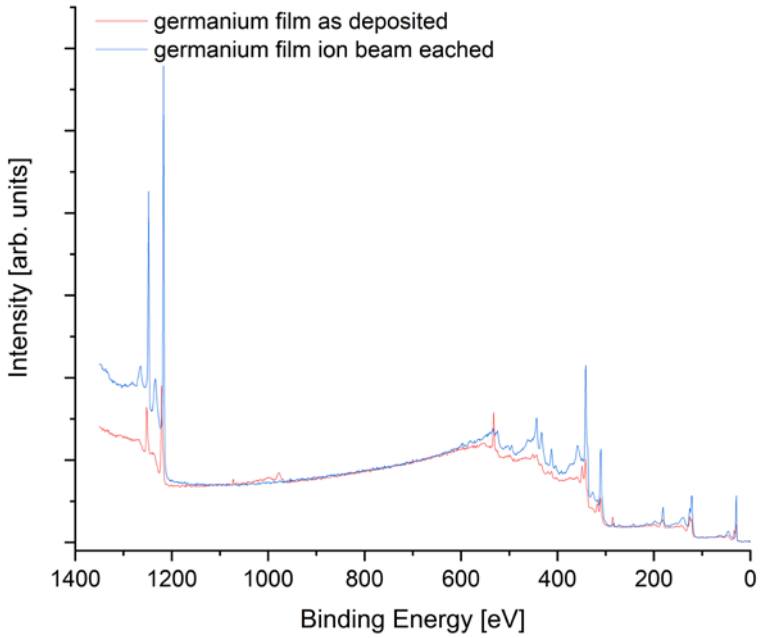

Figure S1: XPS of a germanium film deposited from germane **1** at 300 °C

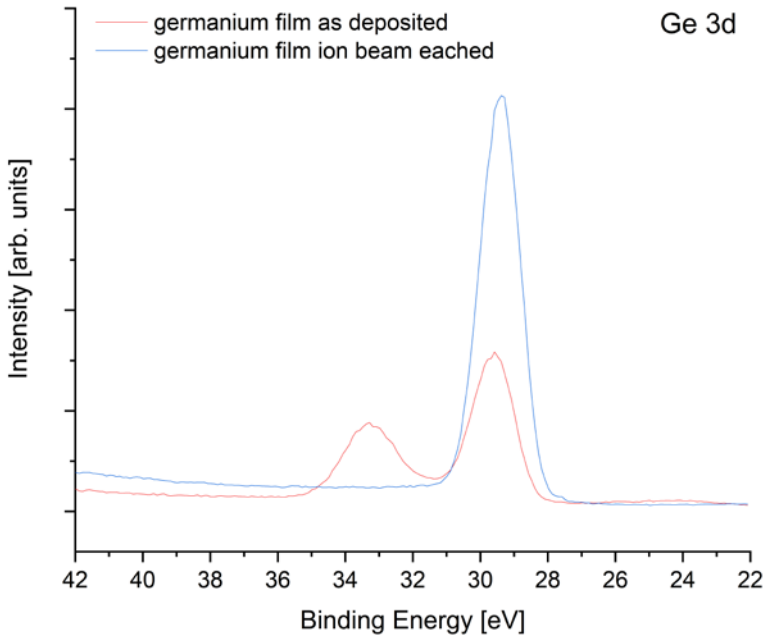

Figure S2: Ge 3d high-resolution XPS of a germanium film deposited from germane **1** at 300°C

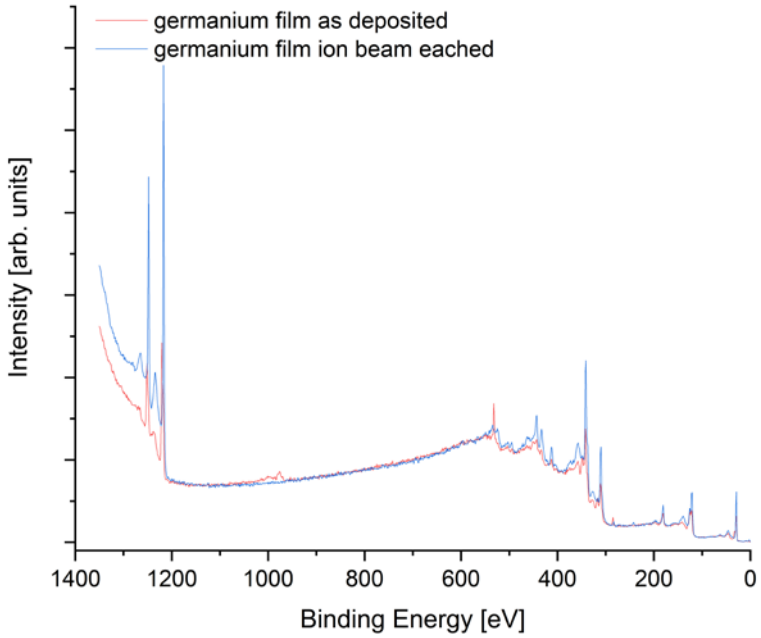

Figure S3: XPS of a germanium film as deposited from germane **1** at 325 °C

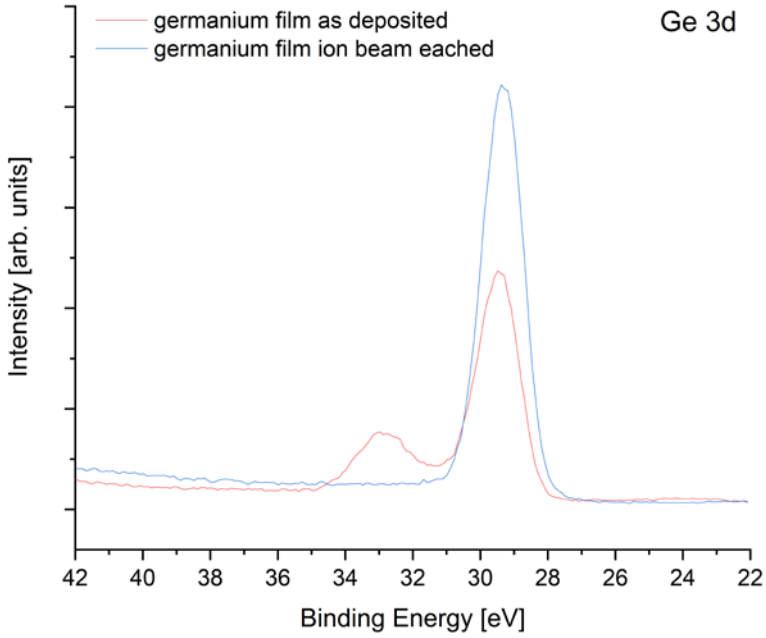

Figure S4: Ge 3d high-resolution XPS of germanium film as deposited from germane **1** at 325 °C

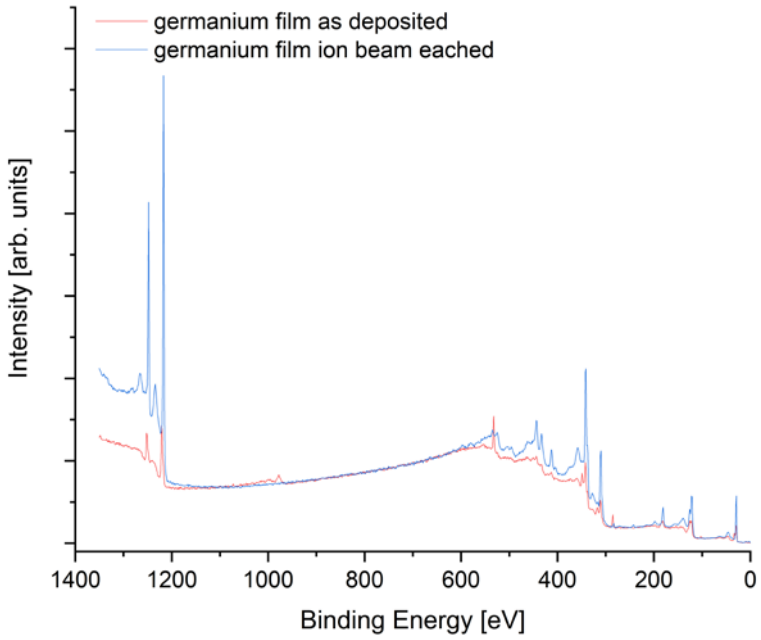

Figure S5: XPS of a germanium film as deposited from germane **1** at 350 °C

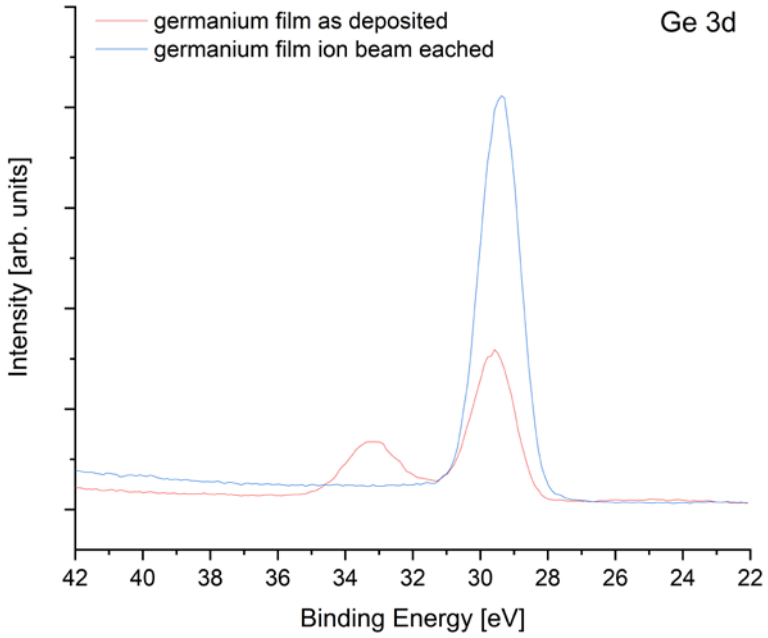

Figure S6: Ge 3d high-resolution XPS of a germanium film as deposited from germane **1** at 350 °C

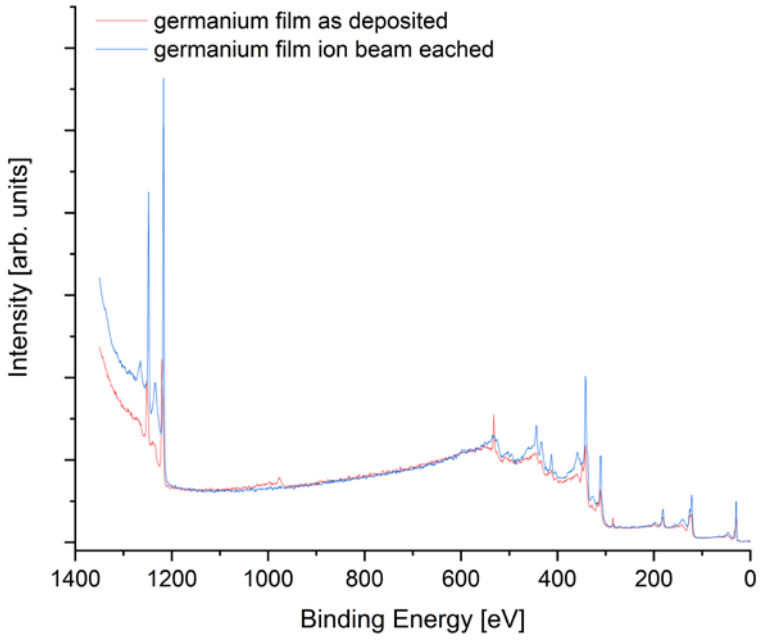

Figure S7: XPS of a germanium film as deposited from germane **2** at 275 °C

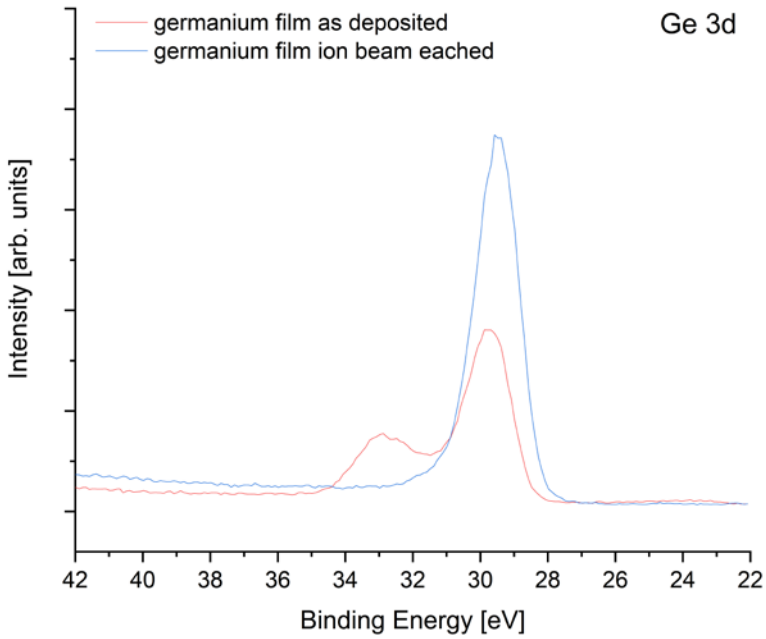

Figure S8: Ge 3d high-resolution XPS of a germanium film as deposited from germane **2** at 275 °C

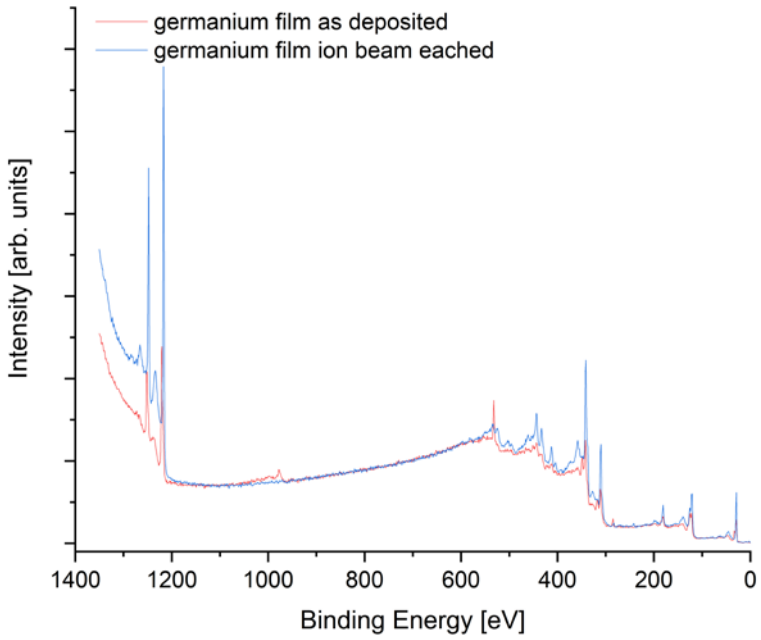

Figure S9: XPS of a germanium film as deposited from germane **2** at 300 °C

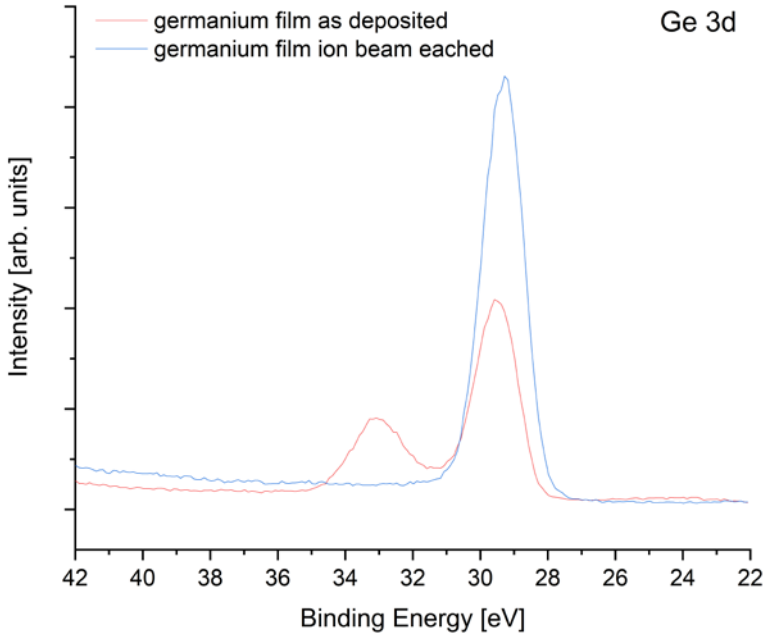

Figure S10: Ge 3d high-resolution XPS of a germanium film as deposited from germane **2** at 300 °C

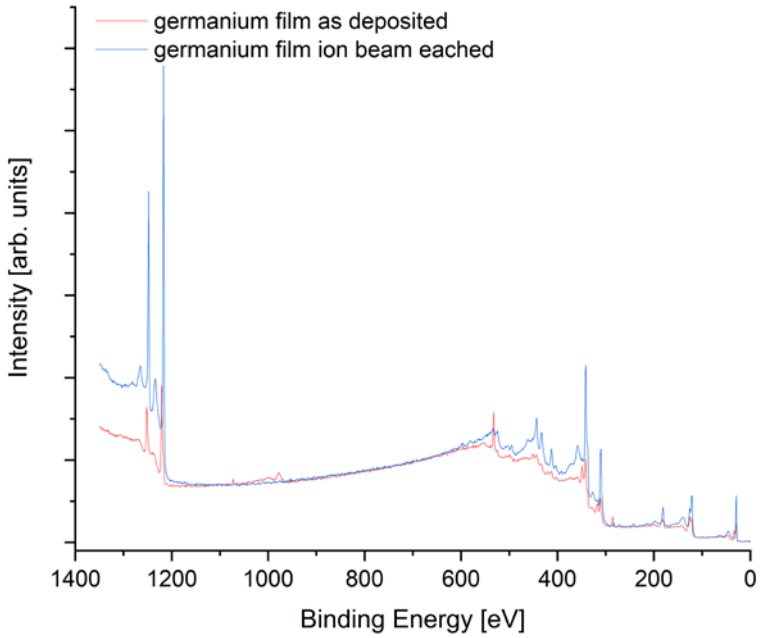

Figure S11: XPS spectra of a germanium film as deposited from germane **2** at 325 °C

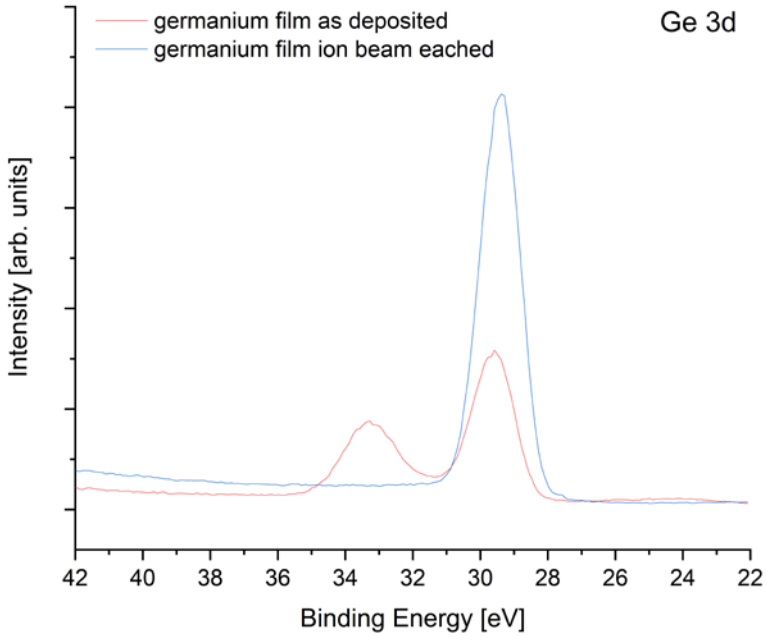

Figure S12: Ge 3d high-resolution XPS of a germanium film as deposited from germane **2** at 325 °C

AFM measurements

Atomic force microscopy (AFM) was used to determine the layer thickness and the surface properties of the deposited layers on solid substrates such as glass or silicon. The results determined in this way allow a very precise statement about the layer thickness. A disadvantage of this type of layer thickness determination is the destruction of the sample, since the germanium layer has to be scratched down to the substrate with a stainless-steel needle. Stainless steel was chosen for the scratching (Figure 1 - 1) because it is softer than glass or silicon and thus destruction of the substrate could be excluded (Figure 1 - 2). At the edge created in this way, the thickness of the layer and the surface roughness could easily be determined in a single measurement. The germanium films deposited on silicon were prepared as described and the layer thickness was then measured in the middle.

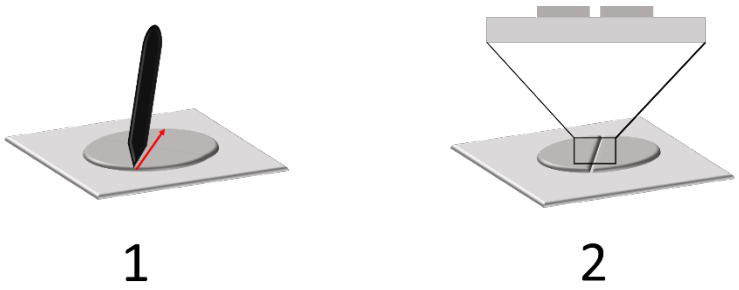

Figure S13: Schematic representation of the sample preparation with a stainless-steel needle (1) and side view of the prepared sample (2)