Poly vinyl alcohol PVA with poly ethylene Glycol PEG added as a binder for the powder compaction

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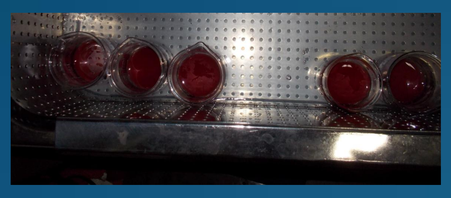
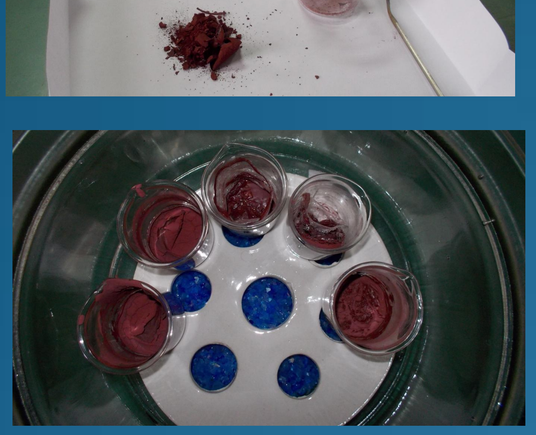
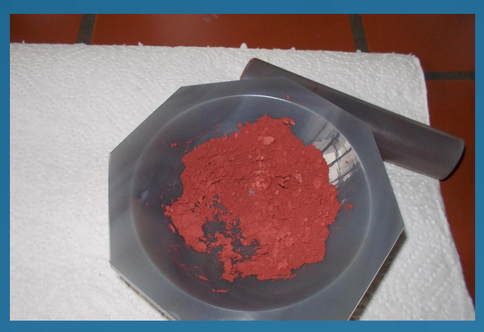
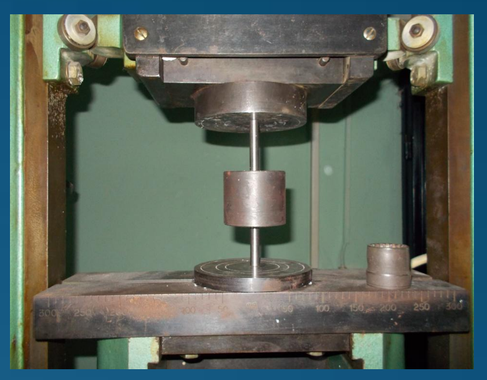


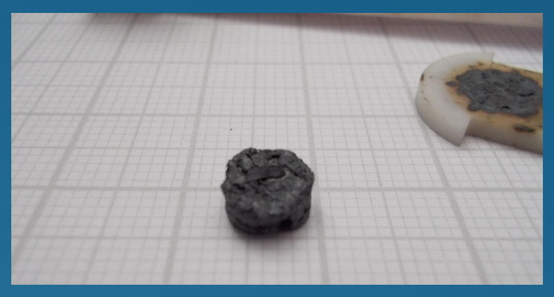
During compaction of the powder mixture of ZnO and Mn_2O_3 ($MnCO_3$) and Fe_2O_3 compacts were found to be fragile for further handling.

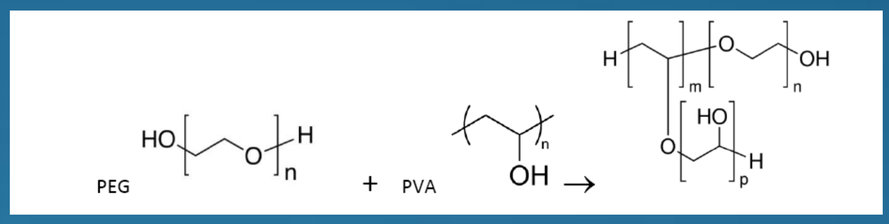
Poly vinyl alcohol (PVA) was used as a binder with an unusual 20% PVA content. We also made 2% PVA with 0.6% Poly ethylene glycol (PEG) and 20% PVA with 6 % PEG. Water solutions of polymers were ultrasonically homogenized with the oxide powder mixture. The suspension was then slowly dried afterwards until all water content evaporated. Extraction from the vessel and crushing manually in an agate mortar was performed before pouring into the anvil mold and piston for compaction.

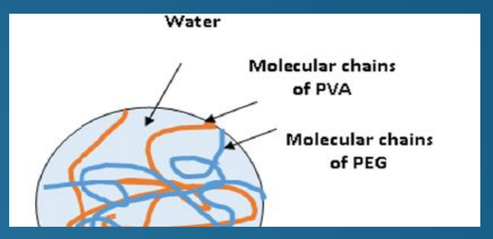








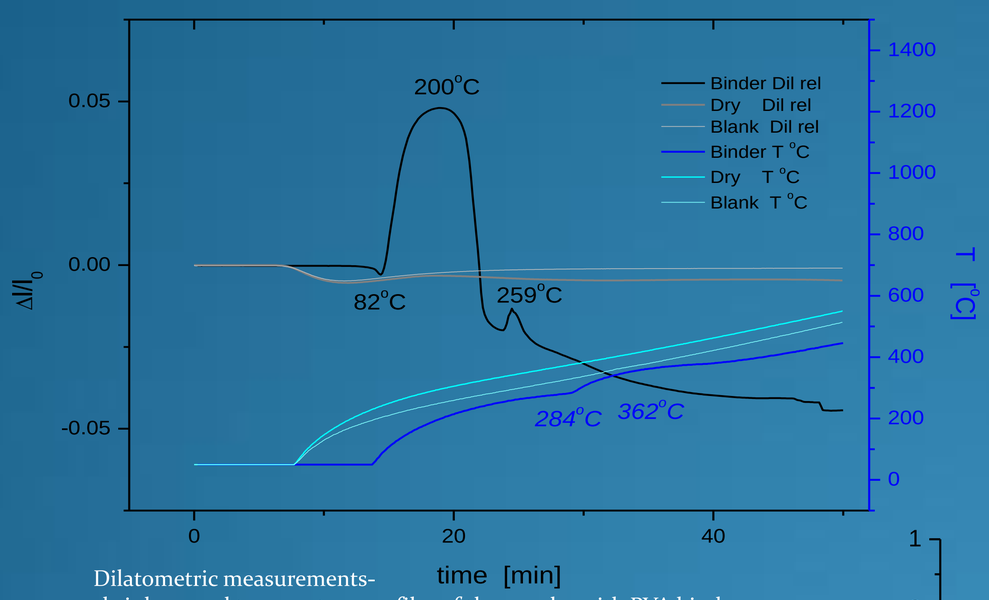




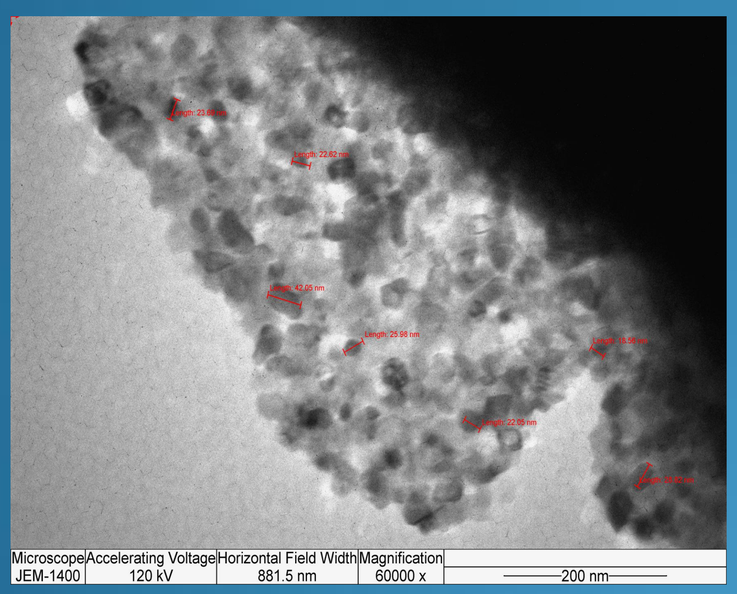
All used PVA binder concentrations gave compacts with good mechanical properties, that could be handled with ease but with addition of PEG as a plasticizer, operating of the anvil and piston became extremely difficult due to friction. Further sintering lead to further sample deterioration due to binder removal.

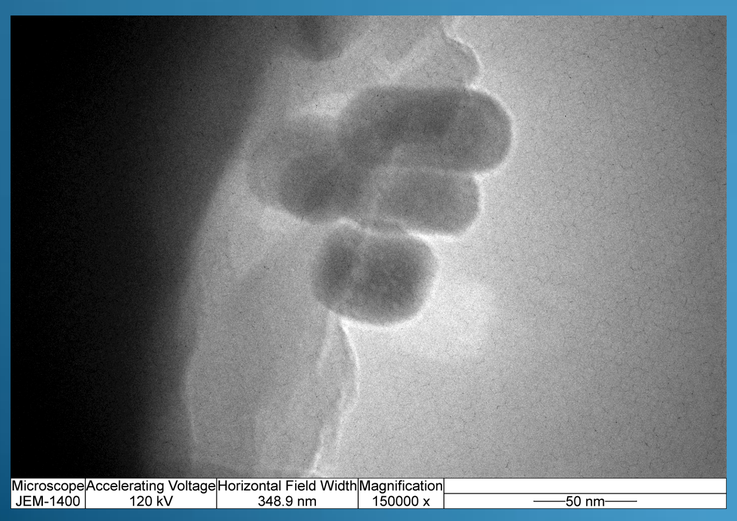
The binder was expected to be wrapped over the powder particles by polymer adsorption from the suspension formed with the polymer water solution. Different concentrations of the polymer should emphasize the type and influence of the binder during sintering.

The following characterization techniques were applied: Dilatometry, Fourier Transformation Infrared (FTIR) spectroscopy with the ATR attenuated total reflection technique, as well as Differential thermal analysis (DTA) on a device with low temperature sensitivity and Transmission electron microscopy (TEM).

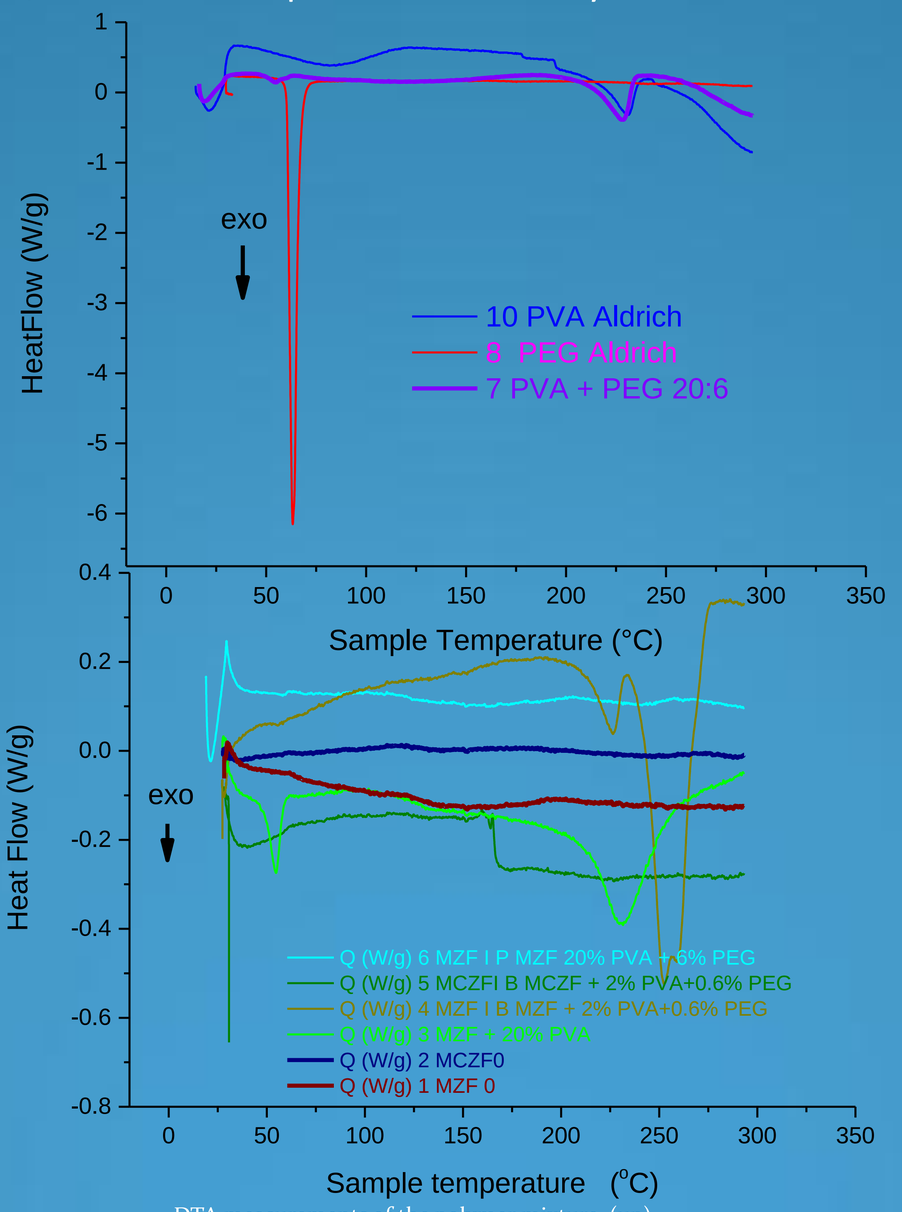


Dilatometric measurements- shrinkage and temperature profiles of the powder with PVA binder

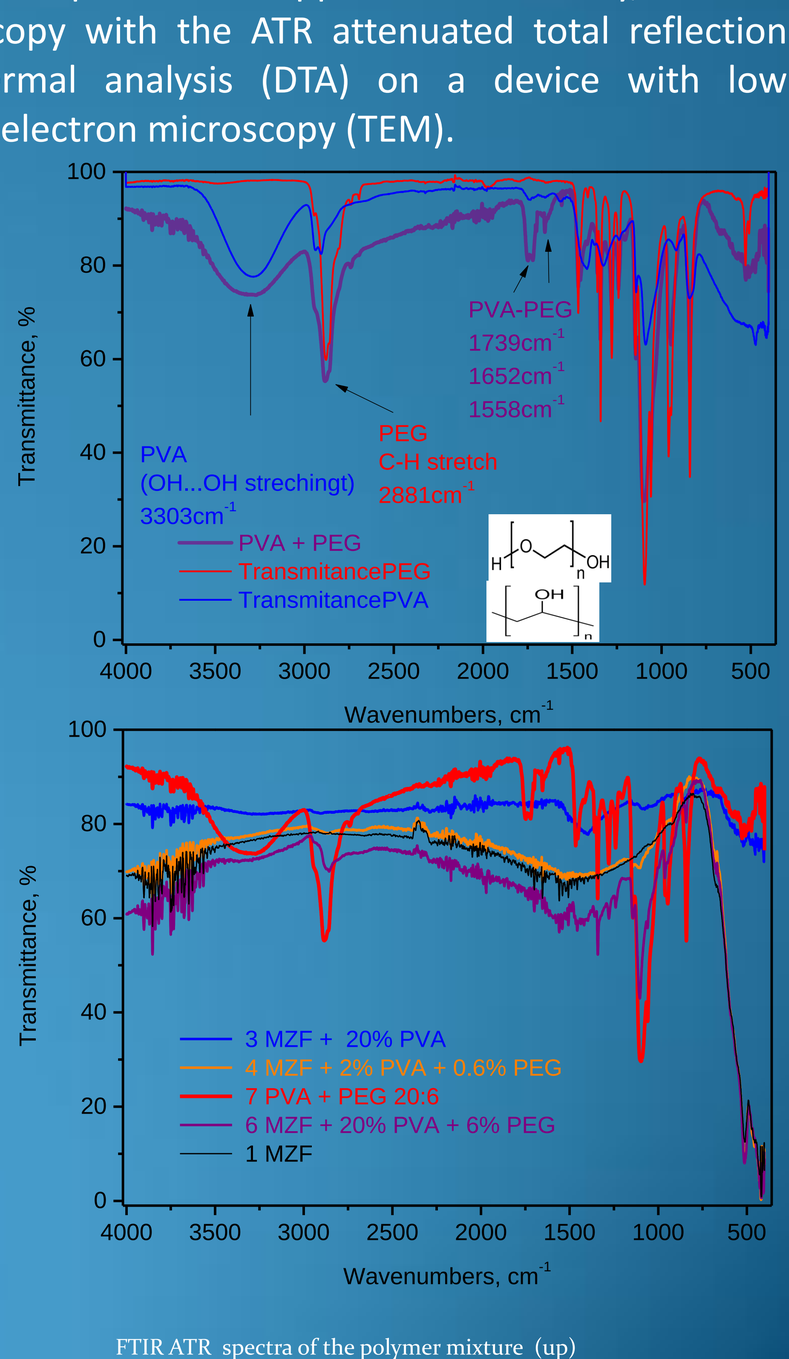




TEM micrographies of the powder embeded within PVA-PEG polymer



DTA measurements of the polymer mixture (up) and oxide mixture powders with polymer mixture coated (down)



FTIR ATR spectra of the polymer mixture (up) and oxide mixture powders with polymer mixture coated (down)