

Determination of hydrolysis and condensation in sol-gel reactions

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Coatings for specialty applications require high temperature and abrasion resistance and at the same time should provide sufficient flexibility during shaping. These requirements are accomplished with coatings produced from sol-gel reactions consisting of multi-component systems of different silanes. Temperature and abrasion resistance are obtained from highly crosslinking silanes besides a certain degree of flexibility is gained by low crosslinking organic modified silanes. To create products with designed properties it is necessary to control the sol-gel process based on hydrolysis and condensation. The determination of hydrolysis and condensation is presented for the performance of the overall reaction (Figure 1). Results from commonly used ATR-IR measurements are compared to time-resolved ^1H - and ^{29}Si -NMR, Karl Fischer titration and inline conductometric measurements for the detection of consumption of water during hydrolysis and release of water through condensation.

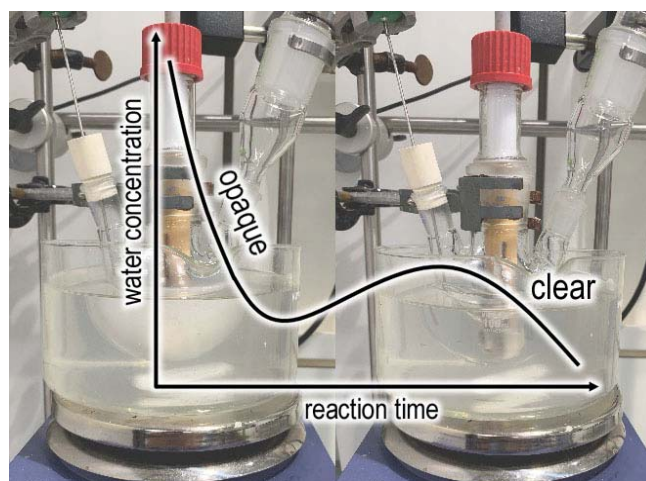


Figure 1: Progress of hydrolysis and condensation for the sol-gel reaction. Opaque reaction solution turns clear after sufficient hydrolysis.