Fluorolytic Sol-Gel synthesis: A new approach towards nanoscopic metal fluorides

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The *fluorolytic* sol gel synthesis of nanoscopic metal fluorides has been developed by our group over the past 8 years. The principle consists in the reaction of a metal alkoxide with anhydrous HF in alcoholic solution resulting in an OR against F exchange (*fluorolysis*)

$$M(OR)_n + n\ HF \longrightarrow MF_n + n\ ROH \qquad (1)$$

resulting in metal fluoride sols which – under appropriate conditions – can be converted into nanoscopic pure Lewis acidic metal fluorides with a very high surface area [1-3].
By combining the *fluorolytic* with the *hydrolytic* sol-gel synthesis this approach can be further extended, thus giving access to metal hydroxide fluorides (eq. 2) or oxide fluorides (eq. 3).

$$M(OR)_n + n\text{-}x\ HF + xH_2O \longrightarrow M(OH)_xF_{n-x} + n\ ROH \qquad (2)$$

$$M(OH)_xF_{n-x} \xrightarrow{T} MO_{x/2}Fn\text{-}x + H_2O \qquad (3)$$

Due to their unique properties, these new materials are of interest for applications in catalysis, optical materials, ceramics, and inorganic-organic hybrid materials. Thus, along with physico-chemical data, examples for catalytic and optical applications will be presented.

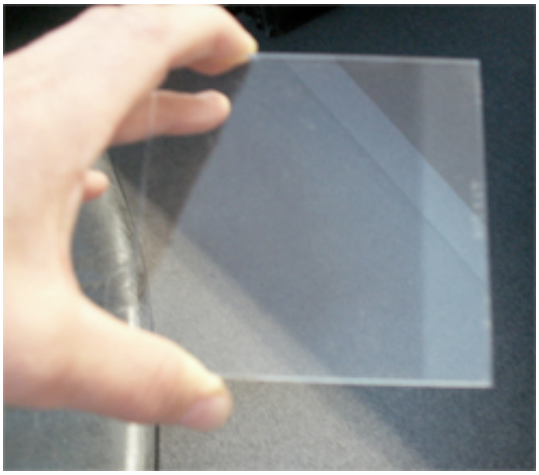
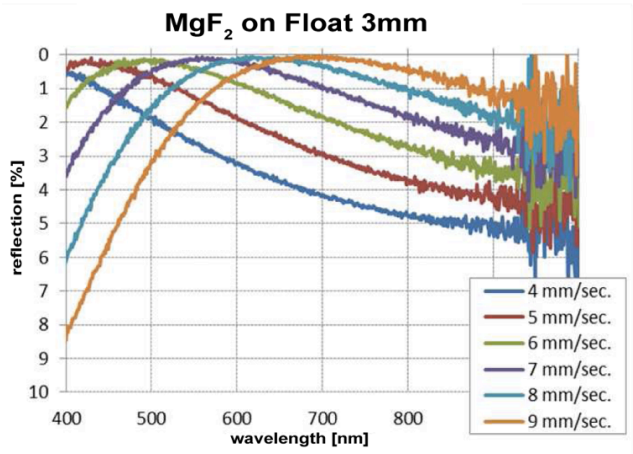


Image to illustrate the antireflective effect of an MgF_2 coating on glass



Optical data for MgF_2 layers of different thickness.

Based on nanoscopic metal fluorides even new composite materials with exciting optical, thermal and mechanical properties are accessible.

[1] E. Kemnitz, U. Groß, St. Rüdiger, S.C. Shekar, *Angew. Chem. Int. Ed.* 42 (2003) 4251;
[2] S. Rüdiger, U. Groß, E. Kemnitz, *J. Fluorine Chem.* 128 (2007) 353.
[3] S. Rüdiger, E. Kemnitz, *Dalton Trans.* (2008) 1117.