Novel High Barrier and Piezoelectric Nanocomposites based on Fluorinated Polymer

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Objectives and Challenges

- Thermo-mechanical treatment (e.g. annealing)
- Development of a high pressure composite storage vessel with self-sensing piezoelectric liner
- Crystalline phases α, polar-β
- Piezoelectric and Gas-Barrier properties

Materials and Microstructural Analysis

P(VDF-TrFE)

Semicrystalline polymer with interesting electric properties originated from its molecular conformation and the chain packing in the crystalline regions

Clay – Cloisite 15A

Organically modified mineral commonly added in nanocomposites because of its layered structure and dispersibility in suitable media

Presence of α and polar β crystalline phases in P(VDF-TrFE)

The phase β is responsible for the piezoelectric properties of polymer

Conclusions

- Annealing PVDF-TrFE at 130°C for 4h increases d33 by 40% and decreases oxygen permeability by a factor of 9.
- The increased β-phase proportion upon annealing is responsible for the combined increase of piezoelectric and gas-barrier properties.
- Addition of clay leads to exfoliated nanocomposites (0.5 vol%) or microcomposites (> 2 vol%) with no change in crystallinity and no improvement in piezoelectric properties.

Acknowledgements

Swiss National Science Foundation
Pr. Damjanovic, Ceramics Laboratory, EPFL