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Materials with optimized properties for H_2 storage

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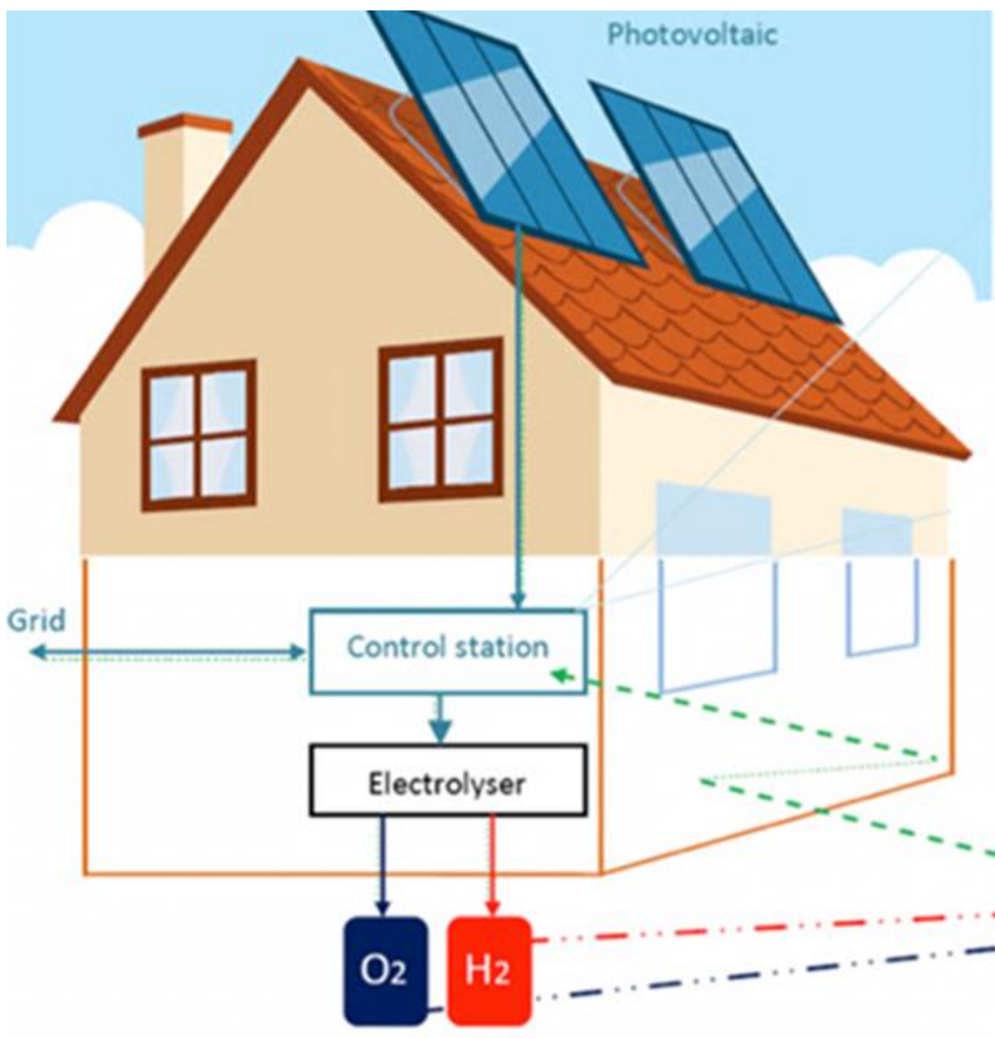
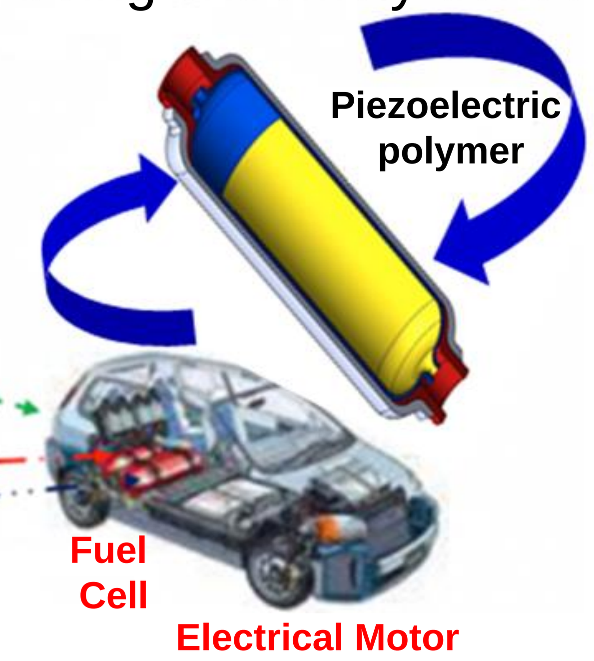
Introduction

Our main affords are focused on the principle of the use of solar energy (collected on home roofs), which can be used to electrolyze water in order to produce H_2 and O_2. The idea is to compress these gases and stored locally, filled in car reservoirs and transposed to electricity for fuel cell driven cars. Safety related to hydrogen storage in a car or at home is a key topic.

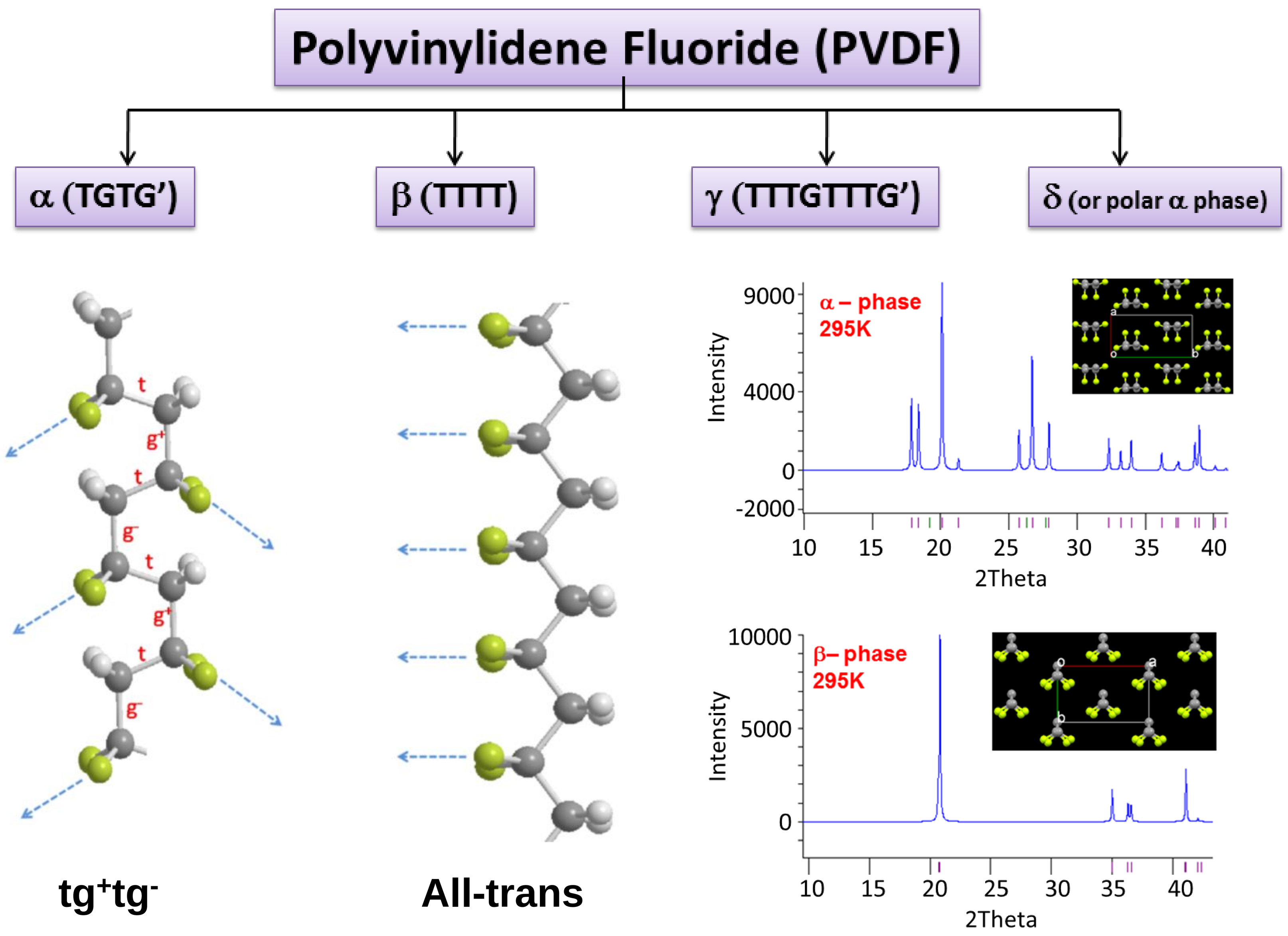


Therefore, the materials used in hydrogen gas tanks have to be deeply characterized. For this purpose, the PVDF is investigated as a material being extremely dense.



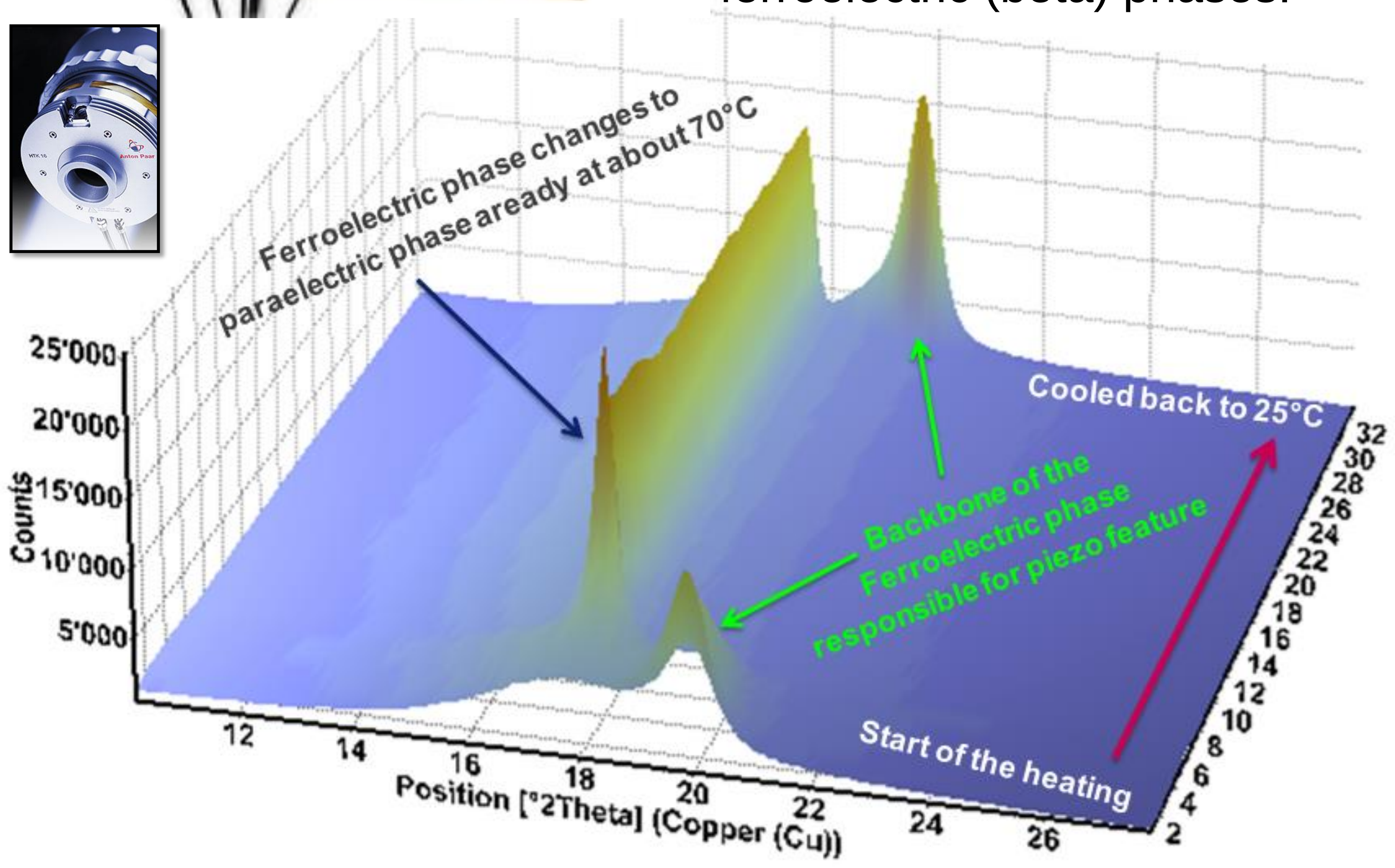
PVDF and *PVDF-TrFE*

Ferroelectric polymers, such as polyvinylidene fluoride (*PVDF*) and poly[(vinylidenefluoride-co-trifluoroethylene] [*P(VDF-TrFE)*], are very attractive for many applications because they exhibit good piezoelectric and pyroelectric responses and low acoustic impedance, which matches water and human skin.

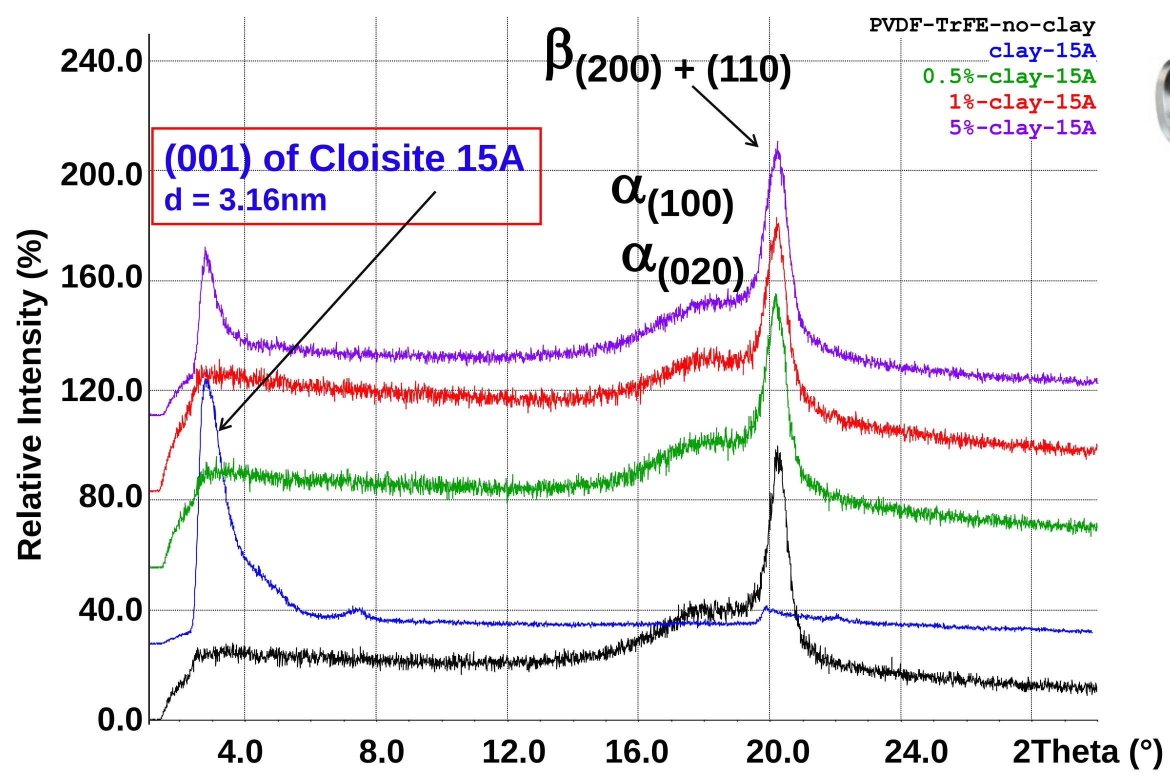


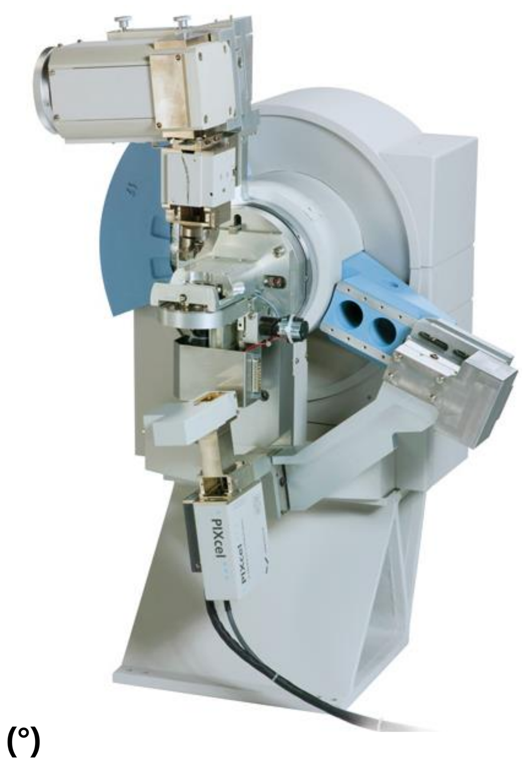
In-situ High Temperature XRD

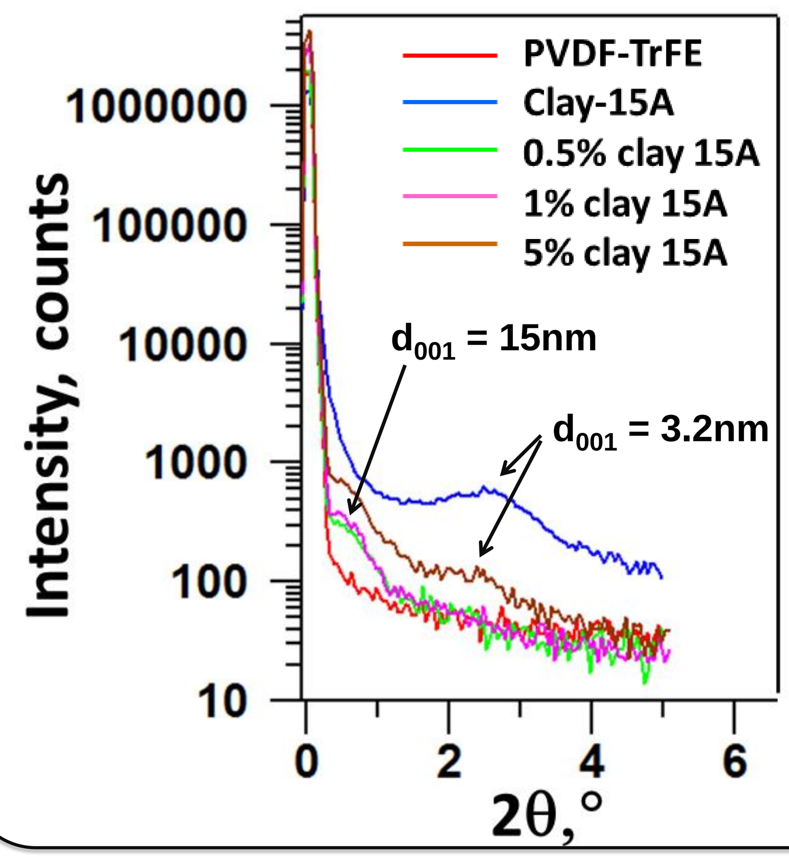
In situ XRD observations of the PVDF-TrFE sample has been done up to 130°C . At this temperature sample was kept during 2 hours. Analysis of the obtained diffractogram shows coexistence of the paraelectric (alfa) and ferroelectric (beta) phases.



Polymer/organoclay nanocomposites







SAXS technique reveals the information which CAN NOT be obtained by Wide Angle X-ray Diffraction. For the small wt% (0.5 and 1%) of the clay in PVDF-TrFE, the exfoliation of the clay is taking place completely (the disappearance of the d_{001} peak). **5-times increase in the *d*-spacing from 3 to 15 nm!**

Conclusions

X-ray diffraction methods establish the structure/property relationship for the piezoelectric PVDF and its copolymer (PVDF-TrFE) as material being extremely dense and as a pressure sensor. The films structure and *in-situ* High Temperature X-ray diffraction studies have provided a direct confirmation of the co-existence of the paraelectric (α) and ferroelectric (β) phases. SAXS results confirms the approximately full exfoliation of the organoclay Cloisite 15A in PVDF-TrFE matrix, which is in favour of strong clay-polymer interactions.