CROSSLINKING OF VDF-BASED POLYMERS BY γ-RADIATION: IMPROVEMENT OF NETWORK DENSITY

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Poly (vinylidene fluoride) is characterized by high intrinsic properties associated with the presence of a strong CF bond, responsible for its good chemical and thermal stability and its low surface energy. These properties provide a wide range of applications, from the medical field to the energy one. However, for some specific applications, excellent physicochemical affinity with a given liquid medium as well as a conservation of the dimensional integrity is required. These antagonist properties can be insured by crosslinking the material through an irradiation process such as the use of γ-ray. Compared to traditional methods which consist in a prior chemical modification of the polymers, this strategy can be applied on materials already processed.
The mechanisms of the homopolymer radiolysis [1] are relatively well known and involve free radical species which nature and concentration can be measured by ESR [2]. The main scope of this work is to study and improve the crosslinking of PVDF-based polymers induced by γ-radiation. The macroscopic behavior of the irradiated material is related to the ability of the polymer to form crosslinks or chain scission. The network formation is revealed by swelling test while crosslinking density can be evaluated from rheological measurements.
Finally, a part of the study is focused on the increase of crosslinking efficiency. For this purpose, a chemical crosslinker which is sensitive to free radical reactions was incorporated into the polymer matrix. Thus, a significant improvement in properties is revealed. Moreover, the impact of radiation dose, crosslinker concentration or type of atmosphere during the radiation process is evaluated and their impact on mechanical properties is elucidated.

References

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