Devulcanization of EPDM from Roofing Systems waste by combined Thermo Mechanical and Microwave process

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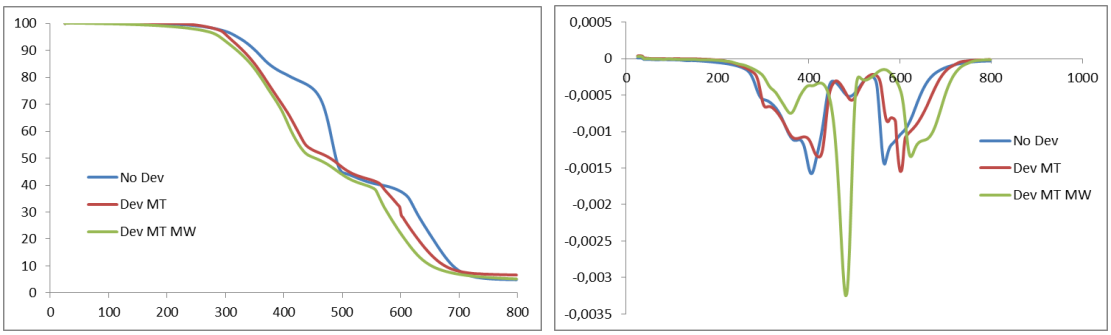
1. Introduction – Vulcanized rubbers are materials commonly used in various industrial applications. In this study, scraps of ethylene- propylene-diene rubber (EPDM) from commercial, industrial and residential roofing systems were submitted to combined thermo-mechanical and microwave processes. The devulcanized EPDM (Dev-EPDM) was characterized by crosslinking density, sol fraction content and TGA analysis. Moreover, in order to explore the possibilities of producing useful compounds by using formulations including other components that improve the properties, we have studied blends with 50% of Dev-EPDM and other elastomers like neat EPDM, NR or SBR.

2. Experimental - Combined thermo-mechanical and microwave devulcanization processes has been performed in 3 steps: Thermo-Mechanical process in a Brabender equipment, after a consolidation in a two roll mill and finally the microwave devulcanization in microwave oven adapted with a motorized stirring system designed in PTFE.

3. Results and Discussion – Preliminary results obtained by TGA and DTGA show that the combined thermo-mechanical and microwave devulcanization process define better results on EPDM samples than devulcanization only with TM or MW. The pictures show that the thermomechanical process effect more significantly than microwave, due that TM not only influence over the sulphur bridge also over the main chain.



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Samples of EPDM No Dev, Dev MT and Dev MT MW present differences in crosslinking attributed to the effect of MT and combined MT MW action. The crosslinking density decreases as a function of the treatments in all the analysed samples. These results confirm that for EPDM samples combined devulcanization is more efficient, allowing subsequently the breaking of sulphur bridges during devulcanization, than in case of samples devulcanized by MW or not devulcanized.
From the analysis of mechanical properties we can conclude that the revulcanization of different elastomeric samples made by DevEPDM and neat EPDM create a linkages by the revulcanization process, which links the DevEPDM particles through covalent bonds. The results obtained by the other techniques applied to the samples corroborate this.

5. References

[1] X, Colom, Marc Marın-Genesca, R Mujal et al. *J Comp Mat*, **52**(22) (2018) 3099
[2] R. Mujal, M. Marín Genescà, X. Colom *AFINIDAD*, **74**, 580 (2017) 247