Creep properties of polymer films used as greenhouse roof

Khaled Djakhdane1, Abdelkader Dehbi1\*, Mecheri Aouinet1, Pietro Picuno2

1Engineering Physics Laboratory, University Ibn Khaldoun, BP 78, 14000 Tiaret, Algeria.

2SAFE School, University of Basilicata, via dell’Ateneo Lucano, n.10, 85100 Potenza, Italy.

\**Corresponding Author* – phone: ++213(0)658198501, fax number: ++213(0)46259141, e-mail address: [abddehbi@gmail.com](mailto:abddehbi@gmail.com).

**Keywords.** Multilayer films, Polymer, Mechanical properties, Greenhouse, Creep-recovery tests

**Abstract.** Polymers are employed in agriculture in several applications, the most efficient and fruitful of which is the protection of cultivations through the use of cover placed over plants while they are growing, providing protection from climatic factors, while at the same time increasing yield and/or extending the cropping season. Plastic films used for covering greenhouses, low and medium tunnel and for soil mulching have reached very notable consumptions all over the Mediterranean area, as well as the rest of the World, posing an important environmental problem connected with the impact that plastic material has on the sustainability of the agricultural production, whose environmental footprint may be deteriorated. Recycling agricultural plastics is a common technique, but it has not yet solved the problem of their re-use in the framework of a circular economy, since many factors are still anyway limiting the mechanical recycling of agricultural plastic materials. Among these limiting factors, the loss of mechanical properties of plastic film, due to its ageing after being exposed to external agents - mainly, solar radiation- plays a crucial role.

In this paper, some polymer films used for greenhouse roof were naturally weathered for 9 months in harsh climatic conditions (Tiaret region, Algeria). The changes in their mechanical properties have been measured by tensile and creep-recovery tests. The measurements were carried out for both monolayer and tri-layer films. The anisotropic character of the films has been preserved during ageing. The improvement in the creep resistance via cross-linking for both monolayer and tri-layer films has affected different deformations. The results revealed that the degradation performance of these new tri-layer films is found to be quite better than that of the monolayer film, with regard to the mechanical properties. Hence, it may be concluded that the erosion of the greenhouse polymer film by temperature, water, sand particles, wind and humidity, leads to extreme lifetime limits. Polymer film may anyway have longer period of use in Mediterranean Europe than in North Africa - where higher temperatures and adverse sand–wind effects occur - with positive effects on reducing the plastic footprint of agriculture.