

A Novel On-line UV Irradiator for Evaluating the Photo, Thermal and Oxidative Degradation of Polymers

Robert R. FREEMAN

Quantum Analytics, 363 Vintage Park Drive, Foster City, CA 94404-1185, U.S.A

Tetsuro YUZAWA, Chuichi WATANABE,

Frontier Laboratories Ltd., 1-8-14 Saikon, Koriyama, Fukushima, 963-8862, Japan

The physical and chemical performance of most polymeric materials gradually degrades due to external effects such as heating, photo radiation, oxidative atmosphere, humidity and mechanical stress. During the degradation process, both the volatile degradation compounds formed and the structural changes of the polymer itself are important pieces of information. This information may help formulate advanced materials by suggesting modifications to the polymer's molecular structure and/or selecting appropriate additives.

Recently, a new analytical instrument which combines an on-line micro-ultra violet (UV) irradiator, a multi-functional micro-furnace pyrolyzer, and a high performance metal capillary column interfaced to a GC/MS has been used to monitor polymer degradation. The system has proven useful for the analysis of the volatile, degradation products emanating from polymeric materials during photo, thermal and oxidative exposure. The residual irradiated polymer is then characterized using evolved gas-MS analysis and pyrolysis-GC/MS.

The effectiveness of the system will be illustrated by irradiating polystyrene, polypropylene and polycarbonate. The volatiles formed will be identified. In addition the residual degraded polymers will be characterized using EGA-MS and PY-GC/MS. The precision of the technique will be reported.