

## Detection of Oxidation and Deterioration of Polycarbonate (PC) by Chemiluminescence (CL) Assay

March, 2014

### Introduction

Polycarbonate (PC), used as an engineering plastic, has high impact-resistance and is highly transparent to visible light.

It is used for eyewear lenses or automotive components. PC is very stable to oxidation. It is very difficult to detect changes during the early stages of oxidation.

Molding processing conditions affect the oxidation of polymer, and therefore it is important to know the oxidation level of pellets but detection of the early stage of pellet oxidation is difficult.

In this report, the detection of oxidation level of PC pellets was attempted. Also the anti-oxidant abilities of phenolic and phosphorus based antioxidants added to PC were measured.

The chemiluminescence technique provides a simple rapid procedure for the detection of oxidation levels and oxidation stabilities of polymer without there being any need for chemical reagents or delicate skills.

### Methods and Results

Polycarbonate was molded several times (1,5 times) at 270C, 310C. Time-course of chemiluminescence of molded PC and virgin PC (PC-VG) was measured by CLA-FS4 under non-isothermal measurement, 50C-140C, 10C/min, nitrogen flow (Fig.1). Fig.2 shows the CL area under each molding condition. The CL increase depends on the molding temperature and times.

For comparison of antioxidant ability of additives, ADK stb AO50 (ADEKA, 2000ppm) as a phenolic antioxidant, and Hostanox P-EPQ (Clariant, 2000ppm) as a phosphorus based antioxidant were used. The CL was measured by non-isothermal measurement, 60-200C, 10C / min under N<sub>2</sub>.

Fig.3 showed the CL intensities of each PC samples, PC without antioxidants, PC+AO50, PC+P-EPQ and PC+AO50+P-EPQ (mix). PC was oxidized by heating at 330C resulting in peroxides being produced. The CL increase depends on the amount of peroxides. Each additive suppresses the oxidation and the production of peroxides. Therefore, the difference compared to PC without antioxidants indicates the antioxidant ability of each additive.

**System : CLA-FS4、CLS-SH1**

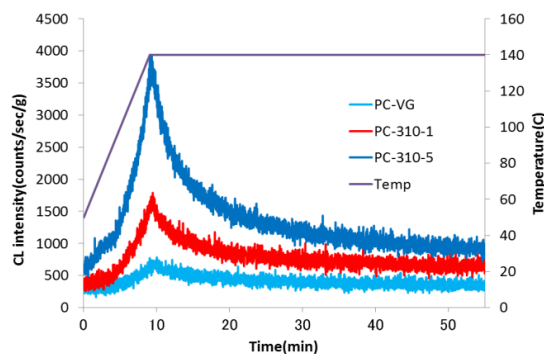


Fig.1 CL time-course change of PC molded 1,5 times at 310C.

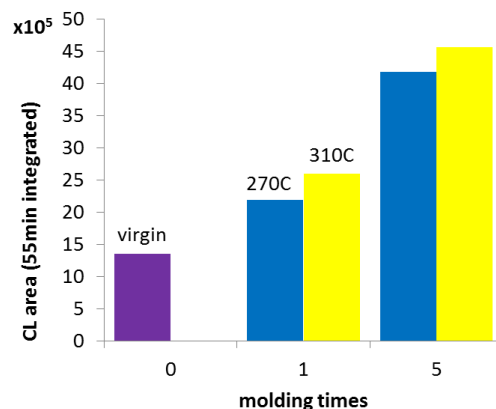


Fig.2 CL area of PC molded 1,5 times at 270C and 310C.

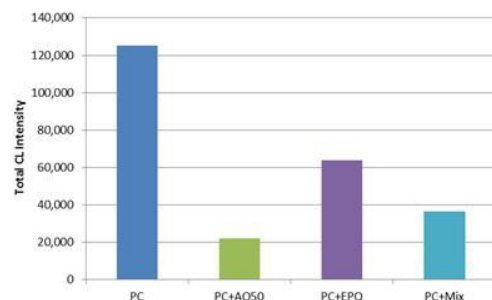


Fig.3 CL of PC with and without additives