



TECHNICAL INFORMATION SHEET 18

Reverte masterbatches – the photo-initiation phase explained.

1. Introduction

Previous Technical Information Sheets (TIS 9, TIS 9B and TIS 16) have described the degradation characteristics of films containing Reverte masterbatches when subjected to heat and/or light.

This Technical Information Sheet has been raised to address a question raised regarding the photo-initiation stage of Reverte containing films.

2. Theoretical considerations.

Reverte masterbatches are designed to introduce an oxo-biodegradable characteristic into certain polymers.

This means that products made from polymers containing Reverte will, in the presence of oxygen and energy, undergo oxidative chain scission until the polymer's molecular weight is sufficiently reduced to allow microbial-based biodegradation.

The rate of this initial oxidation stage is controlled by the presence of sacrificial free radical scavengers ("energy absorbers") that prematurely remove the energy required for the oxidation, hence preventing it happening until they are exhausted.

However, in addition to this, Reverte products have been formulated to have an extra level of protection against premature oxidation through the inclusion of a photosensitive, but very efficient free radical scavenger. This package is deactivated by a small exposure to natural light which means that the initial breakdown reaction only occurs at a very low rate until it is phototriggered.

The level of photoexposure required, which has to be natural rather than artificial light, is around 6 to 10 hours of outdoor exposure in a typical Northern European climate and should not be regarded as a "bullet" but as a gradual "topping-up" procedure.

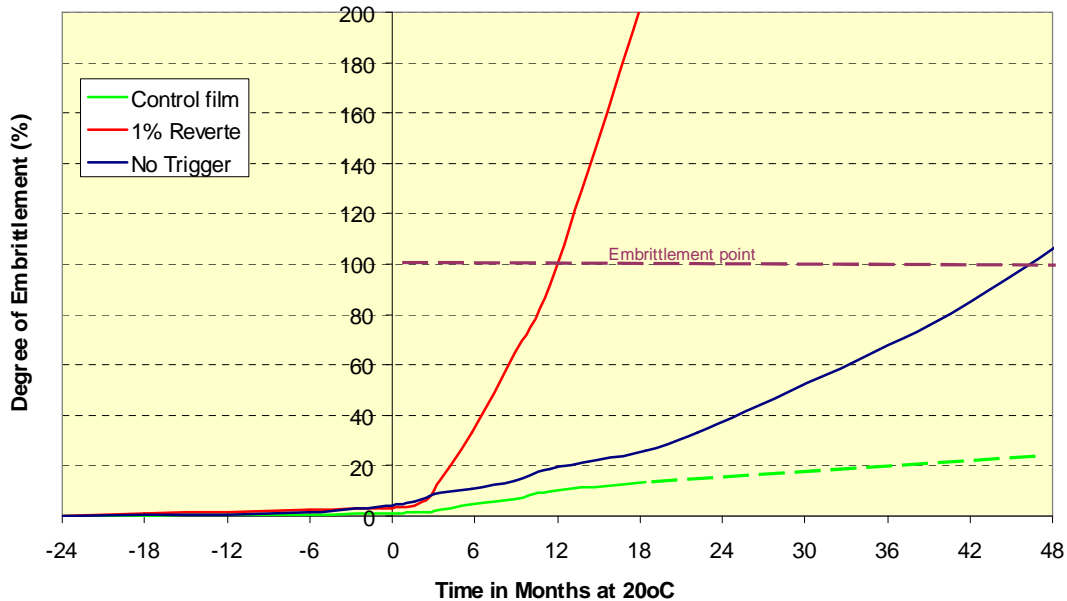
It should be understood that the oxidation reaction will still occur in the absence of any light exposure, but it will take between 18 and 24 months to initiate.

This gives extra confidence against premature degradation as without any outdoor light exposure the product will have an 18 to 24 month shelf life before the onset of oxidation.

The graph below helps to clarify the kinetics of the reaction.



3. The breakdown kinetics of a PE film containing 1% Reverte BD 92845.



The curves were obtained from ageing the specimens in accelerated ageing cabinets with and without photo-exposure and measuring their rate of degradation or “degree of embrittlement”.

Arrhenius principles were used to calculate their respective behaviors in “real-time” at 20°C.

The blue curve represents a film that has not experienced any photoexposure. For this curve the time starts at -24 months. It can be seen that it has exhibited a dwell time of around 18 to 24 months followed by a steady development of embrittlement over the next 48 months.

The red curve shows the behavior of a Reverte specimen. Point zero on the graph indicates the time of photoexposure and this film shows a characteristic dwell time of around 4 months following the phototriggering and a rapid development of embrittlement over the next 8 months.

The green curve represents a control sample without any Reverte additive. It has been aged alongside the red curve specimen. It can be seen that there has not been any significant development of embrittlement over a four year timescale.

The blue curve specimen will be transformed into the red curve specimen at any point along its lifetime by an appropriate level of phototriggering.


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