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NEWS

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JOANNEUM RESEARCH – MATERIALS

Novel technology to increase pot life of Silicones used in LED components

Improved formulation for a Silicone elastomer can lead to significantly reduced production costs for LED components. JOANNEUM RESEARCH is looking for partners in the LED, phosphor and PDMS market to exploit the potential of this technology.

Most LED components use special silicones (PDMS) as matrix for the colour conversion phosphors, or as the favourite material for primary optical lenses attached to the LED package. In LED production, two component systems of such elastomers are preferred. Upon mixing of the two components the curing process of the silicones starts almost immediately, and the mixture usually has a pot life limited to a maximum of few hours at room temperature. This poses significant practical and technological limitations for its use, especially in LED production, where additional color conversion phosphors are added to the mixture.

The mixtures have to be produced out of the pristine silicone components and the phosphors in situ at the site of the LED package manufacturer. Usually, the premixed formulation has to be transferred immediately to small cartridges and stored in small portions in refrigerators, which requires a comparatively high labour effort. When used in production of LED components, the viscosity of the mixture has to stay within certain limits. Due to an early viscosity increase caused by the persisting curing reaction in the cartridge a considerable amount of the color conversion mixture has to be discarded in the production process, generating waste and unnecessary high production costs.

The most popular types of silicones require Platinum (Pt-)catalysts to support the curing reaction. To slow the reaction down temporarily, some additives like amines and other compounds can be used, which complex the active metal-centre of the catalyst (e.g., Pt) and inhibit the crosslinking for a certain time. However, the inhibition of silicone curing is often only partially reversible because the inhibitors cannot be removed entirely. As a result, the final crosslinked elastomer will have different properties compared to non-inhibited materials. Moreover, even partial removal of common inhibitors requires high temperatures, well beyond 100°C. Therefore, these systems are not suitable for production of LED components today.

JOANNEUM RESEARCH has developed a novel method to stabilize PDMS elastomer systems that does not show the drawbacks of state-of-the-art inhibitors. Using this technology, the pot time of silicon mixtures (including color conversion phosphors) can be extended to several months and beyond. This is reducing the processing efforts and increasing the yield of color conversion material in LED-production considerably. After

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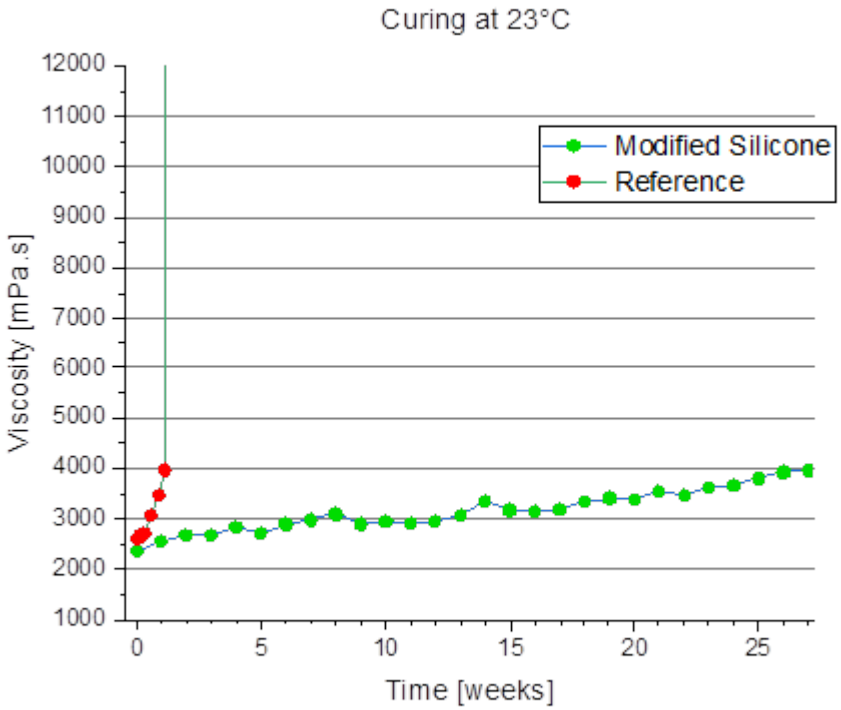
deposition, normal curing occurs at temperatures even below 80°C (which is used for curing of common PDMS in LED components), leading to a fast and complete curing. No change of optical properties of the PDMS and the LED is observed.

A specific advantage of this approach is that the modified silicones can be mixed with color conversion phosphors in rather large batches, increasing the accuracy and consistency of the color conversion pastes.

The change of viscosity over time of a commercial two-component PDMS material and an equivalent modified silicone is shown in the following figure.



The novel technology is patent pending. JOANNEUM RESEARCH is looking for partners in the LED, phosphor and PDMS market to exploit the potential of this technology.

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