

# Facing the challenge of devulcanization of silica-containing tire rubber

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One challenge in terms of sustainability and Circular Economy is recycling of passenger car tires due to the mere number of end-of-life tires (ELT) and the difficulties in getting a high-quality recycled rubber. Devulcanization is one pathway to recover the rubber from ELT's for reuse in new tires. The challenge lies in the composition of passenger car tires: the main polymer being SBR prone to recombination, and the silica-silane filler system used in the tread. The latter poses a problem due to the short and strong bonds between the filler surface and the polymer.

In this study, a SBR-BR based model compound containing a silica-silane filler system was used to screen different potential devulcanization aids (DAs) concerning their efficiency. As DAs, different types of silanes were used. The effect of time, temperature, shear forces, DA type and concentration on the devulcanization process was investigated. The degree of network breakdown, miscibility, processibility of the devulcanized material and mechanical properties of the revulcanized material, not being blended with a virgin rubber compound, were monitored.

As one reference DA, 2-2'-dibenzamido-diphenyl disulfide (DBD) was chosen, using optimized conditions from a former study. Compared to this, the tailored devulcanization process with the most efficient silane-based DA from this screening study results in an increase of network breakdown of app. 25% in absolute values, while the strength of the revulcanizate doubled.

Besides being more efficient, the silane used as DA might also reactivate the silica present in the rubber, which is the topic of future investigations.