Edited by **Ryan Gehm**

Audi R8 light in the rear

Audi's range-topping, mid-engined R8 sports car is not just about performance and aesthetics; precision-fit components and a high level of surface finish are also priorities. Among its prominent design features are two large air apertures at the rear. The rear bumper is a plastic-based, lightweight system that not only has to meet Audi's quality priorities but also to be sufficiently tough to resist damage caused in minor collisions.

To meet the requirements, **Bayer MaterialScience** worked with **WAYAND**, **Quarzwerke**, and Audi to formulate a solution based on a customized grade of its polyurethane system, Bayflex 180. The complete bumper module is supplied by WAYAND, which specializes in exterior and interior plastic components for the automotive industry.

The rear of the car consists of three components: the rear panel, which is connected to the retractable spoiler; the cover, which incorporates the apertures of the two twin tailpipes and the mounts for the transverse struts of the two air apertures; and a diffuser with integrated fog lights that extends down to the underbody of the car. The cover and the diffuser comprise the rear bumper assembly. This assembly spans an area of some 2 m^2 (22 ft^2). Because of its size, manufacturing it in polyurethane constitutes a major design and processing achievement.

A significant ingredient of the Bayflex 180 material grade used is the finely ground reinforcing material Tremin 939-304, produced for the R8 by Quarzwerke. Dieter Gaumitz, a polyurethane bodywork parts specialist at Bayer MaterialScience, explained that it helps to produce an excellent component surface and paint finish. The material also ensures that the polyurethane system remains extremely tough over a temperature range from -30 to +150°C (-22 to +302°F). It makes the bumper highly resistant to stone impact damage. Audi's requirements for precision fit were particularly high in the area of the rear panel and the cover to achieve narrow gaps.

"The minimal thermal expansion of Bayflex 180 proved to be an advantage. It is comparable with that of aluminum," said Gaumitz. He added that another

The rear bumper module of the Audi R8 incorporates a customized grade of Bayer MaterialScience's Bayflex 180.

strength of the polyurethane system is its flow behavior, which facilitates a wide choice of design options, making it possible to produce large, thin-walled components with complex geometries economically, using reinforced reaction injection molding (R-RIM) technology.

Wall thicknesses can be varied as required, those of the bumper and rear panel (the latter also produced from Bayflex 180) being between 2 and 5 mm (0.08 and 0.20 in) near the attachments, averaging some 3.3 mm (0.13 in). Bayflex 180 has a heat resistance of more than 150°C (302°F), allowing rear panels to be fitted very close to exhaust systems.

Bayer MaterialScience's contribution to the joint development work with Audi, WAYAND, and Quarzwerke also included determining the polyurethane parameters that are governed by the rate of elongation. It conducted high-speed tensile tests on specimens. The work enabled the strength, energy absorption, and dynamic load resistance of the rear bumper to be calculated using standard simulation programs and the crash behavior to be evaluated reliably and realistically, according to Bayer. Mold flow calculations for optimization of the flow behavior and the gate design were also made.

Stuart Birch

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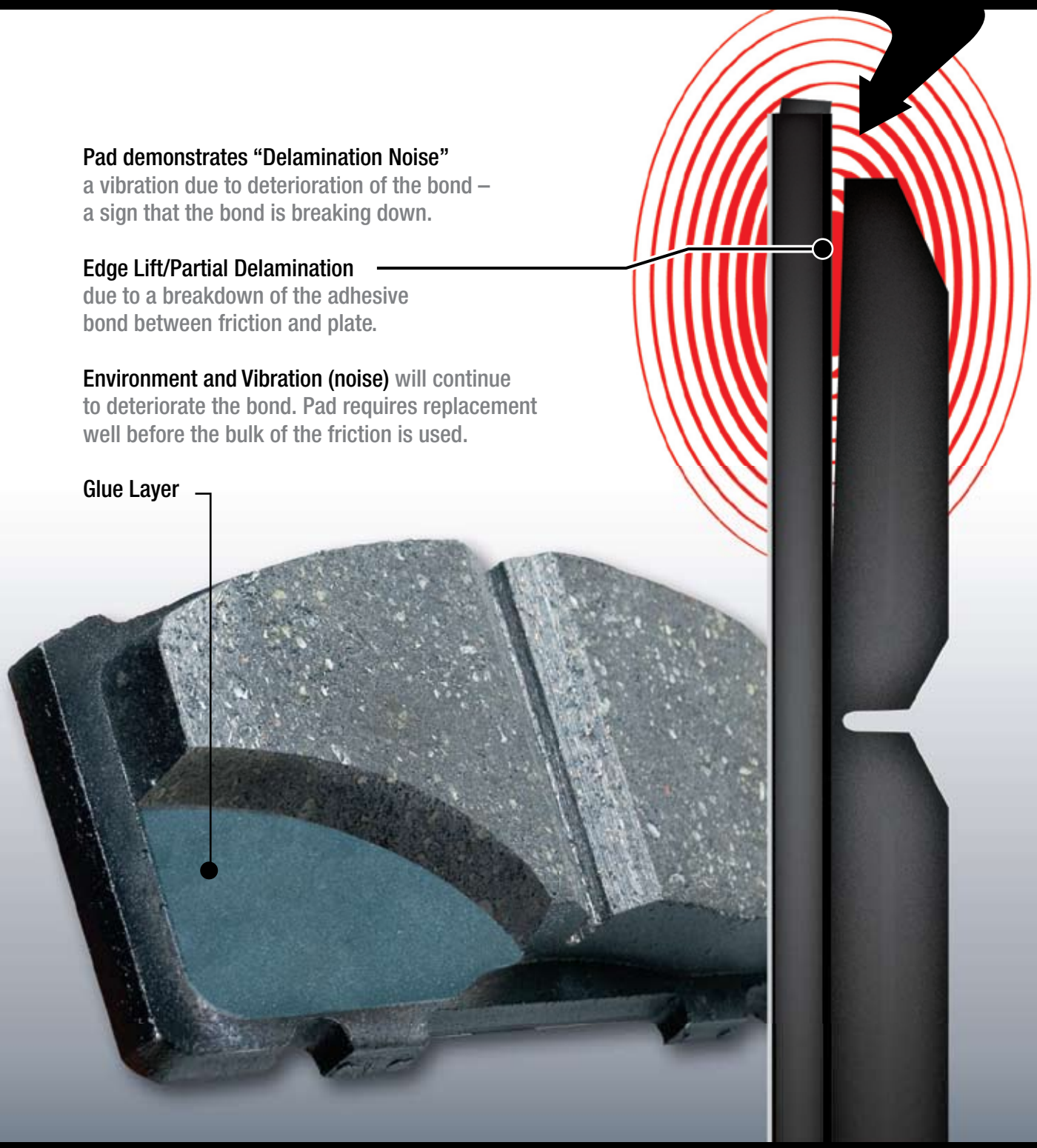

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