



Stretch Release Characteristics of 3M™ VHB™ Extrudable Tape

Technical Bulletin

June 2023

Background

3M™ VHB™ Extrudable Tape has been developed for use worldwide in a variety of industrial applications. As national, regional, and local regulations and standards change, many manufacturers are looking to adapt to regulatory and consumer demands for environmental responsibility to meet their company's sustainability goals. 3M™ VHB™ Extrudable Tape possesses a performance characteristic referred to as "stretch release" (Figure 1). After the adhesive is dispensed onto a substrate and allowed to cool, it can be removed. It offers less waste, faster rework, and easier component recycling.



Figure 1. Stretch release demonstration

How is stretch release performed?

- Stretch as close to a zero-degree, parallel motion in relation to the substrate. Figure 2 demonstrates a zero-degree, parallel stretch direction.
- While it is possible to automate, a slow, manual, hand over hand approach is best.
- It is recommended to secure the substrate or assembly from which the adhesive is being removed.



Figure 2. Zero-degree, parallel stretch motion

How much later after dispensing will stretch release be successful?

To help define when stretch release can be successful, it is necessary to highlight assembly construction. This can be broken down into 4 phases. Phase 1 is the dispensing phase. 3M™ VHB™ Extrudable Tape is dispensed onto a substrate and allowed to cool. Phase 2 is the assembly phase. The second substrate is placed onto the adhesive and pressure is applied to close the bond. Phase 3 is the shipping/storing/using phase. The assembly now potentially can be exposed to elements such as cold, heat and humidity. Phase 4 is the end-of-life phase. This refers to the assembly reaching the end of its utility. Figure 3 highlights ease of stretch release as it relates to each phase.

Phases 1 and 2: It is easiest to stretch release after Phase 1 is complete. When the adhesive cools on the substrate it regains its elongation of 1500% and can be removed from the substrate. After Phase 2 and the adhesive is allowed to cool it also is fairly easy to stretch release. At this stage it is more important to incorporate stretch release tips above to achieve success.

Phases 3 and 4: As the adhesive moves into Phase 3 it becomes important to highlight and consider the ratio of thickness to width of the adhesive bead. Figure 4 helps define these measurements. To calculate the ratio, thickness is divided by the width. An internal study was performed examining the affect of prolonged heat on the ability to stretch release between two substrates. Substrate coupons were bonded together in a sandwich construction using a variety of different substrates and adhesive ratios. These coupons were placed in an accelerated aging condition of 90°C for 30 days and, upon cooling, stretch release testing was performed. It was determined that stretch release was still possible on samples with adhesive ratios greater than or equal to 0.25. For test coupons using an adhesive ratio less than 0.25, only glass as a substrate still offered stretch release. Since 3M™ VHB™ Extrudable Tape was recently launched as a completely new form factor adhesive in Q3 2022, there currently is no way to correlate this accelerated aging to true Phase 3 conditions. There are simply too many variables at play. However, as guidance to aide in defining an adhesive ratio that affords stretch release after some time in Phase 3, greater than or equal to 0.25 is recommended. In conjunction with the unknown variables of Phase 3, there is also no prediction that can be made for Phase 4 at this time. Lastly, if the adhesive does not stretch release the assembly may be heated to 150C. This will soften the adhesive and allow for disassembly and recycling.

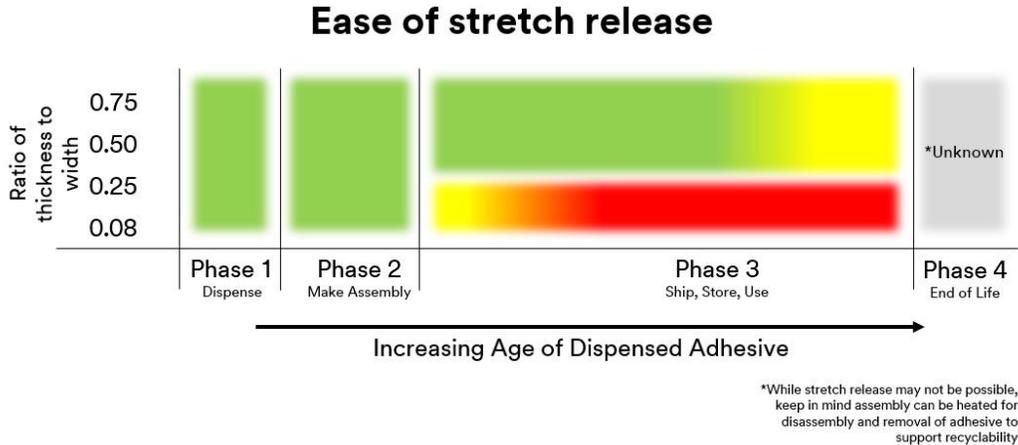


Figure 3. Ease of stretch release as a function of thickness to width ratio of adhesive and time past after dispensing

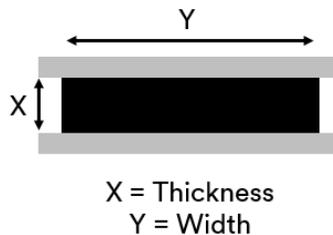


Figure 4. Thickness to width ratio of adhesive used to hold two substrates together.

How should a part be designed for successful stretch release?

- Include an exposed, unbonded amount of adhesive at the beginning or end of the adhesive bead. This creates a “tail” that allows for a starting point for stretch release.
- Use radiused edges on inner substrate surfaces that are bonded. This helps avoid potential adhesive breakage during the stretch release process.
- Set a larger gap between the substrates. This equates to a thicker bead of adhesive and a greater ratio of thickness to width.
- Substrate material choice will affect stretch release especially after accelerated aging.

Conclusion:

3M™ VHB™ Extrudable Tape has 1500% elongation and as such, it can be stretch released from substrates. This capability supports customers sustainability goals as it offers less waste, faster rework, and easier component recycling. Stretch release is successful with any thickness to width ratio for Phase 1 or Phase 2 assembly construction. However, at a ratio of less than 0.25, stretch release can fail in Phase 3.

It is recommended to use an adhesive thickness to width ratio of greater than or equal to 0.25. 3M will continue to better define guidance for successful stretch release in Phase 3 and Phase 4 of assembly construction. As data is generated and analyzed, 3M will update the Stretch Release Technical Bulletin.

Technical Information

The technical information, guidance, and other statements contained in this document or otherwise provided by 3M are based upon records, tests, or experience that 3M believes to be reliable, but the accuracy, completeness, and representative nature of such information is not guaranteed. Such information is intended for people with knowledge and technical skills sufficient to assess and apply their own informed judgment to the information. No license under any 3M or third party intellectual property rights is granted or implied with this information.

Product Use

Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and performance of a 3M product in a particular application. As a result, customer is solely responsible for evaluating the product and determining whether it is appropriate and suitable for customer's application, including conducting a workplace hazard assessment and reviewing all applicable regulations and standards (e.g., OSHA, ANSI, etc.). Failure to properly evaluate, select, and use a 3M product and appropriate safety products, or to meet all applicable safety regulations, may result in injury, sickness, death, and/or harm to property.

Warranty, Limited Remedy, and Disclaimer

Unless a different warranty is specifically stated on the applicable 3M product packaging or product literature (in which case such warranty governs), 3M warrants that each 3M product meets the applicable 3M product specification at the time 3M ships the product. 3M MAKES NO OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR ARISING OUT OF A COURSE OF DEALING, CUSTOM, OR USAGE OF TRADE. If a 3M product does not conform to this warranty, then the sole and exclusive remedy is, at 3M's option, replacement of the 3M product or refund of the purchase price.

Limitation of Liability

Except for the limited remedy stated above, and except to the extent prohibited by law, 3M will not be liable for any loss or damage arising from or related to the 3M product, whether direct, indirect, special, incidental, or consequential (including, but not limited to, lost profits or business opportunity), regardless of the legal or equitable theory asserted, including, but not limited to, warranty, contract, negligence, or strict liability.

Disclaimer

3M industrial and occupational products are intended, labeled, and packaged for sale to trained industrial and occupational customers for workplace use. Unless specifically stated otherwise on the applicable product packaging or literature, these products are not intended, labeled, or packaged for sale to or use by consumers (e.g., for home, personal, primary or secondary school, recreational/sporting, or other uses not described in the applicable product packaging or literature), and must be selected and used in compliance with applicable health and safety regulations and standards (e.g., U.S. OSHA, ANSI), as well as all product literature, user instructions, warnings, and limitations, and the user must take any action required under any recall, field action or other product use notice. Misuse of 3M industrial and occupational products may result in injury, sickness, or death. For help with product selection and use, consult your on-site safety professional, industrial hygienist, or other subject matter expert. For additional product information, visit www.3M.com.

ISO 9001:2000

This Industrial Adhesives and Tapes Division product was manufactured under a 3M quality system registered to ISO 9001:2000 standards.



Industrial Adhesives and Tapes Division
3M Center, Building 225-3S-06
St. Paul, MN 55144-1000
800-362-3550 • 877-369-2923 (Fax)
www.3M.com/vhb

3M is a trademark of 3M Company.
©3M 2021