



**EP62-1HT:
Cyclohexane resistant
epoxy used to bond
critical optical
components**

EP62HT-1: Cyclohexane resistant epoxy used to bond critical optical components

Overview of EP62-1HT

[EP62-1HT](#) is a two-component moderate heat curing epoxy system with a long working life of 12–24 hours at room temperature. It is suitable for many highly demanding aerospace, electronic, and specialty OEM applications, especially where resistance to aggressive chemicals is necessary, even at higher temperatures. It has versatile cure schedules that can be adapted to meet the needs of specific bonding applications, such as adhering an optical pinhole to borosilicate glass, as discussed in this case study.

Application

Electric fields, such as those generated by lasers, can be used to accelerate chemical reactions, but this requires understanding the mechanism of such reactions. Researchers from Stanford University irradiated a cyclohexane solution of cis-stilbene with a nonresonant nanosecond-pulsed IR field to probe one such reaction. In this setup, a nonresonant IR field passed through a solution of cis-stilbene and provided a strong electric field without being significantly absorbed, i.e., it entered and exited the reaction solution mostly unchanged or consumed, behaving similarly to a chemical catalyst. The authors designed and built a vessel to house the cis-stilbene solution while it was irradiated with IR laser and UV light. As part of the design process, the author went through several iterations of the vessel design before finally determining the optimal design. [EP62-1HT](#) played a key role in ensuring that critical components of this vessel remained adhered to each other, even in the presence of the solvent cyclohexane.

Key Parameters

To design an appropriate vessel, the authors needed to ensure that the materials of construction were compatible with the chemicals and laser wavelengths. As noted previously, the author iteratively designed four different vessels before determining the optimal design based on the reproducibility of the spatial overlap of the UV and electric field lasers used

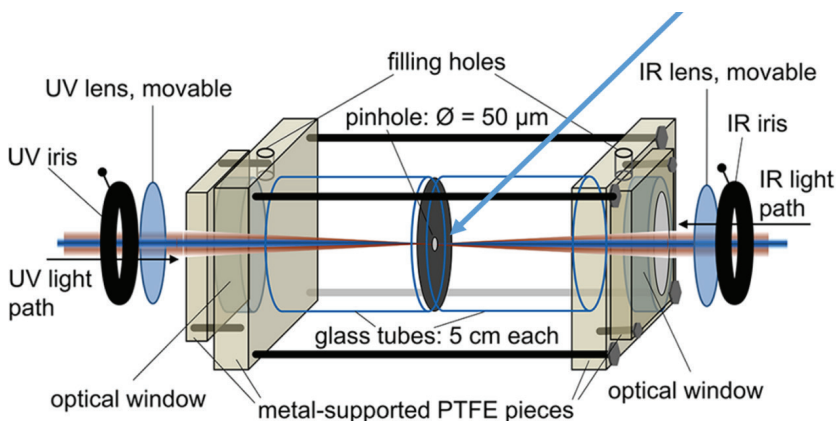


Figure 1. Schematic of the reaction vessel developed to investigate the impact of a nonresonant IR field on the photoisomerization and photocyclization of cis-stilbene [modified from van den Berg et al. 2020].

to irradiate reaction solution samples. As shown in **Figure 1**, the optimal vessel's main body was constructed of two borosilicate glass tubes, between which the authors installed a high-damage threshold pinhole with a diameter (\varnothing) of 50 μm , enclosed within aluminum housing.

This pinhole ensured spatial overlap between the UV laser and nonresonant electric field laser. The pinhole housing material was aluminum and was secured to two glass tubes using a combination of EP41S-5* and EP62-1HT. After curing, EP62-1HT is highly resistant to acids, as well as solvents such as the cyclohexane solvent used in this study.

There are several recommended cure schedule options depending on the application:

- 60-70 minutes at 176-212°F
- 20-30 minutes at 257°F
- Post-curing at 212-302°F for 3-5 hours is also recommended.

Results

Using the optimal vessel design, the results and theoretical analysis showed that the nonresonant IR field induced a dynamic Stark shift that increased the absorption cross-section at the experimental wavelengths. This increased the photoisomerization of cis-stilbene into trans-stilbene, confirming that the non-resonant IR laser enhanced the reaction yield. Despite the authors' optimization efforts, they still observed damage to the pinhole over time, which manifested as pinhole widening. To ensure optimal overlap between UV and IR light, the pinhole was replaced periodically. Master Bond EP62-1HT played a key role in ensuring that the aluminum-housed pinhole remained adhered to the borosilicate glass tubes throughout the experiments, even in the presence of cyclohexane.

*[Master Bond EP41S-5](#) is a two component epoxy system featuring excellent chemical resistance especially to solvents, acids, bases, alcohols and fuels.

References

Van Den Berg, J. L.; Neumann, K. I.; Harrison, J. A.; Weir, H.; Hohenstein, E. G.; Martinez, T. J.; Zare, R. N. Strong, Nonresonant Radiation Enhances Cis - Trans Photoisomerization of Stilbene in Solution. *J. Phys. Chem. A* 2020, 124 (29), 5999-6008. <https://doi.org/10.1021/acs.jpca.0c02732>.

Neumann, K. I.; Measuring the catalytic impact of nonresonant, pulsed radiation on reactions in the gas and solution phases [Doctoral dissertation, Stanford University].

No part of this article may be reproduced or transmitted in whole or in part, in any form, by any means, without the express written permission of Master Bond Inc. All requests for permission to reproduce material from this article should be directed to Master Bond at permissions@masterbond.com. The Master Bond logo is a registered trademark of Master Bond Inc. All other company, product and service names, logos, brands or trademarks are the property of their respective owners and are used for identification purposes only. No endorsement is implied.

© 2023 Master Bond Inc. All Rights Reserved