

Photodegradable Phosphate Triester-based Networks for Debonding-on-demand Coatings



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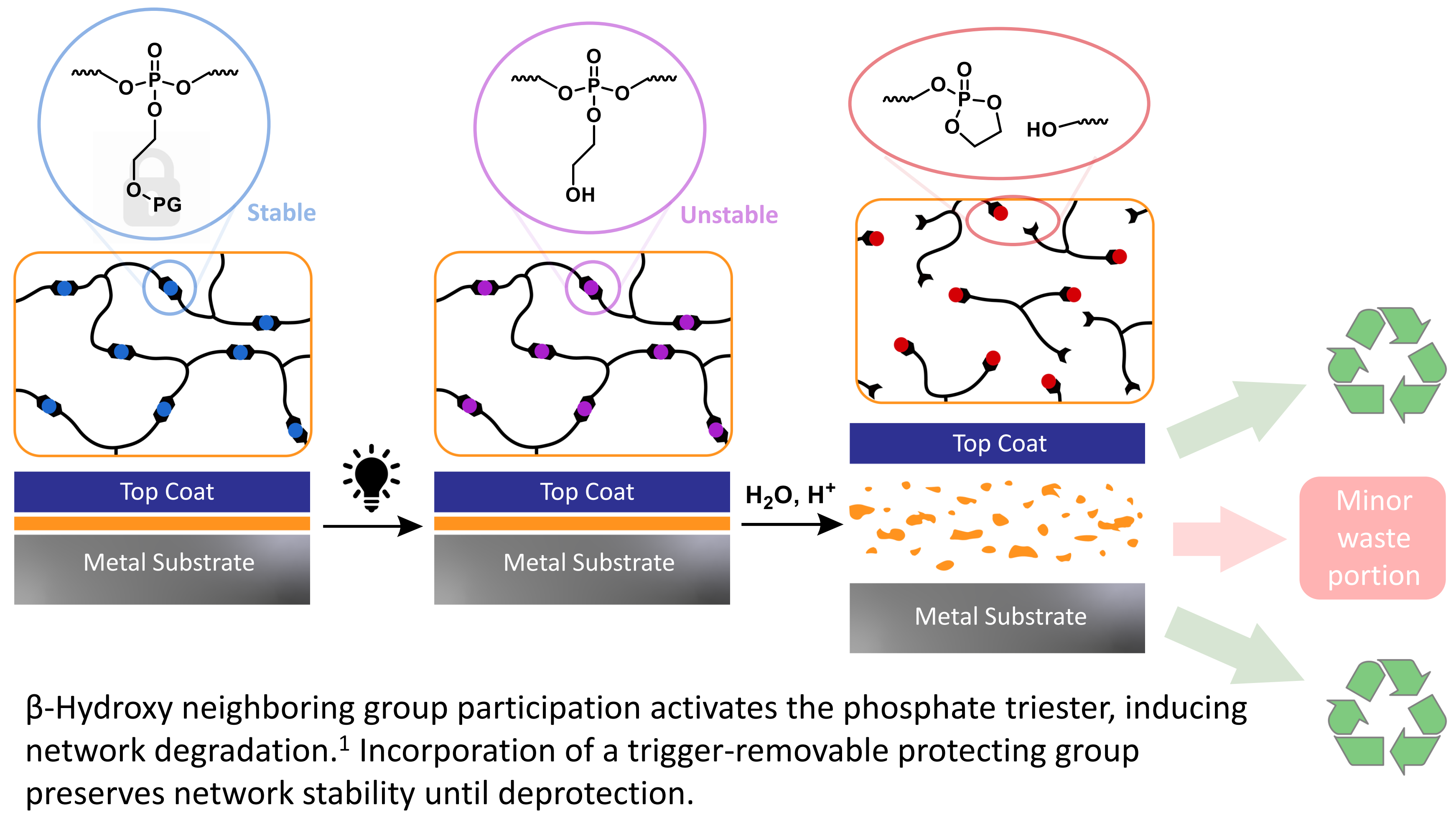
Supramolecular Polymer Chemistry group

Introduction



Coatings are used in many everyday products, but their complex structures make them **hard to recycle**. As a result, coated materials often end up in landfills. To make products **more sustainable**, we need coatings that work well but can also be easily removed without harming the surface underneath.

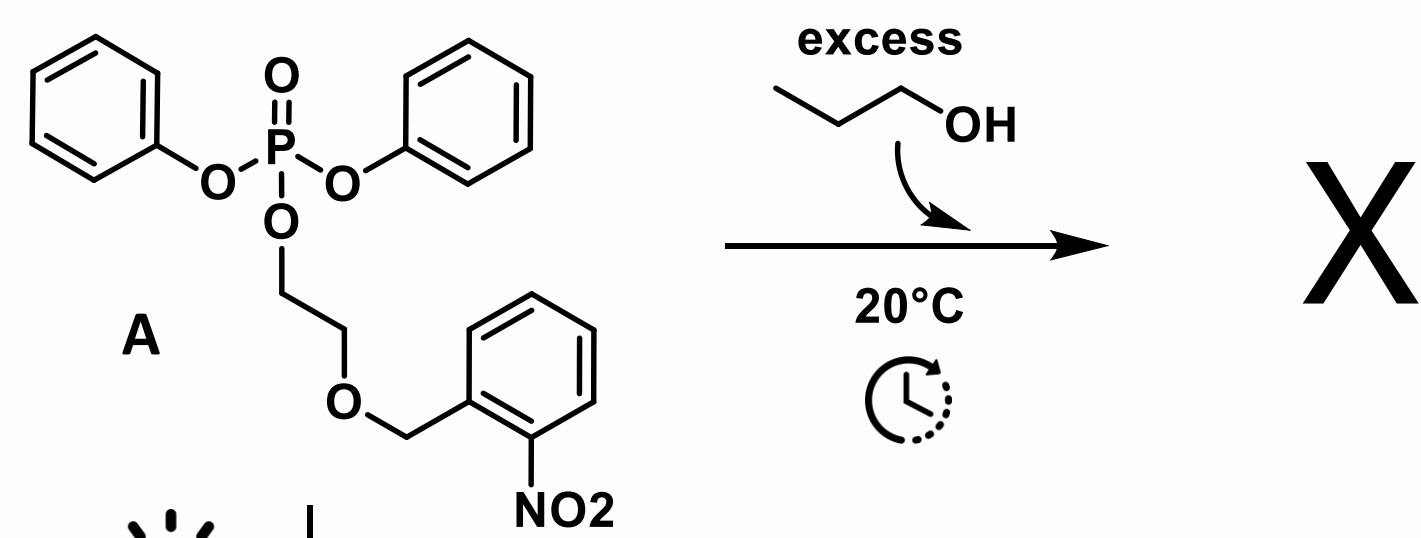
Strategy



β -Hydroxy neighboring group participation activates the phosphate triester, inducing network degradation.¹ Incorporation of a trigger-removable protecting group preserves network stability until deprotection.

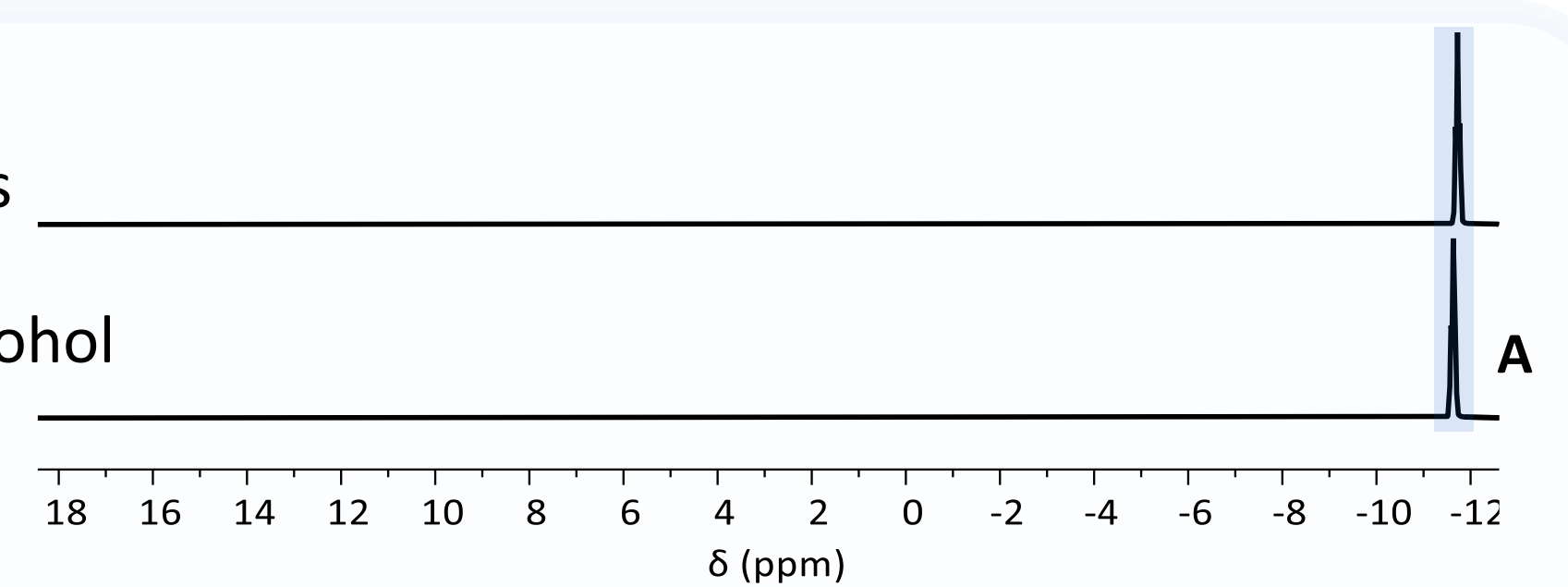
Proof of Concept

Protected

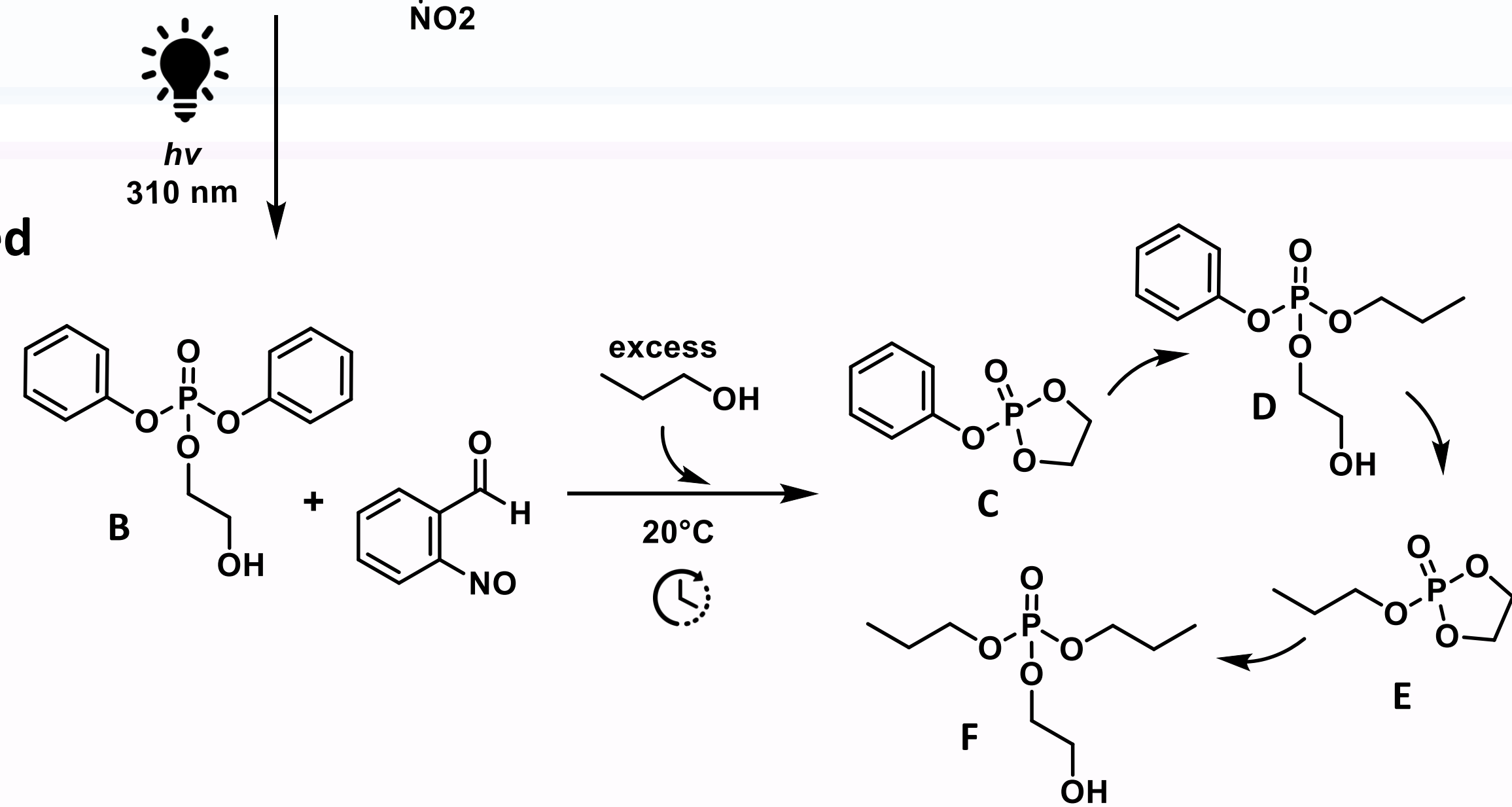


30 days

pre-alcohol



Deprotected



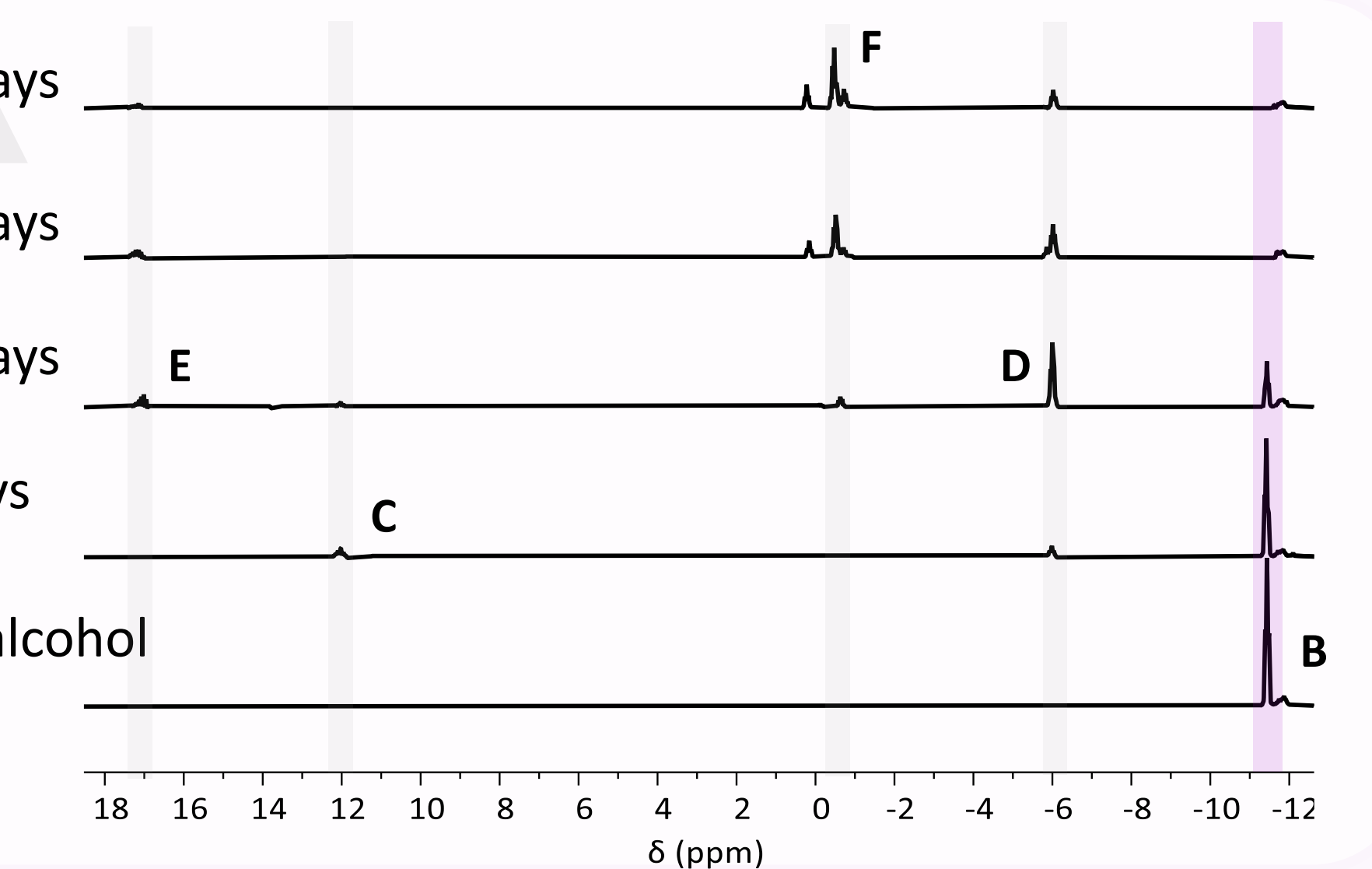
30 days

20 days

10 days

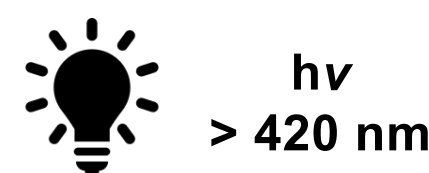
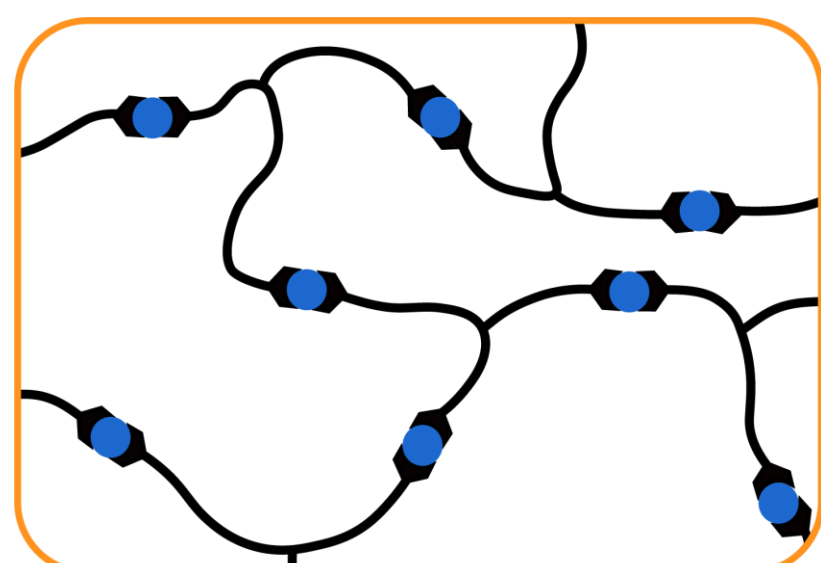
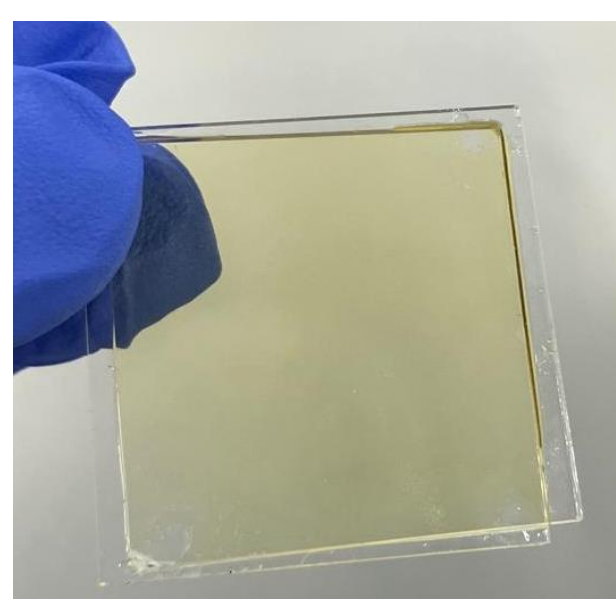
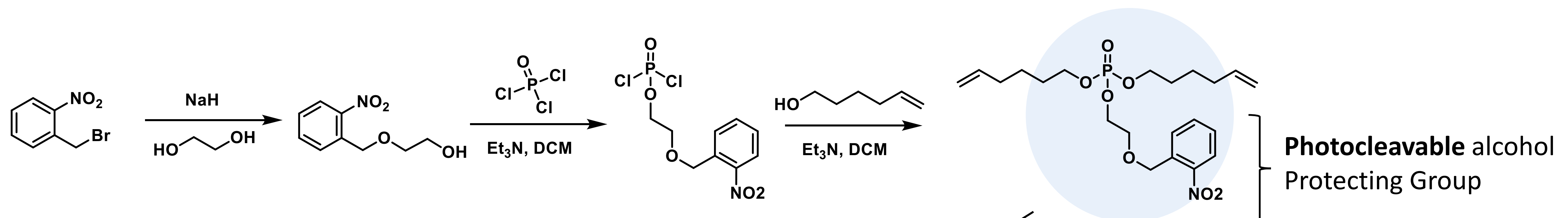
5 days

pre-alcohol

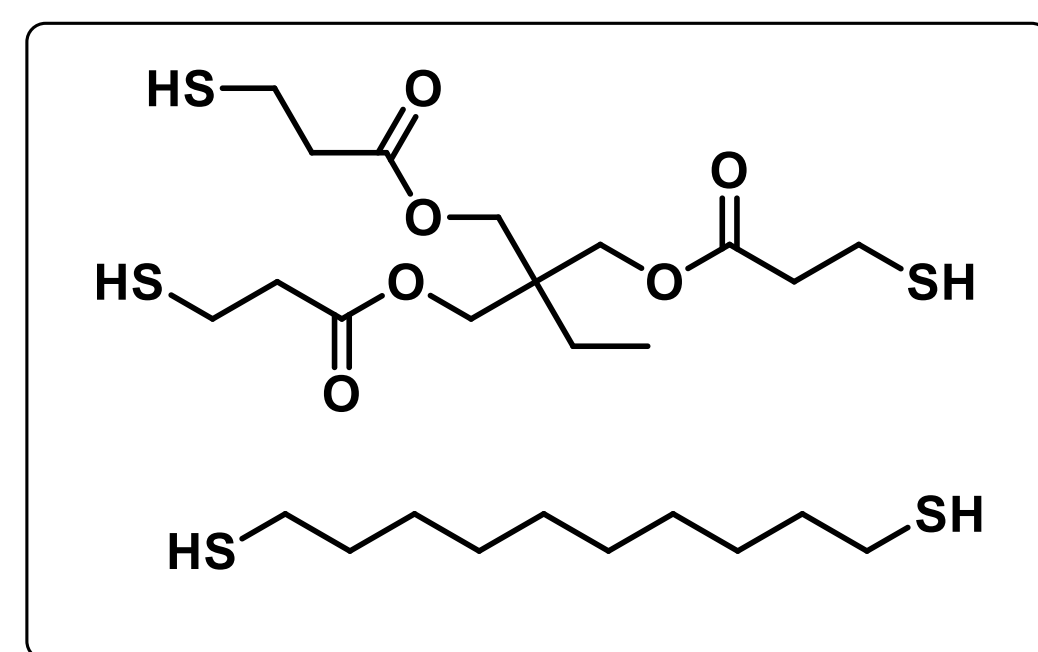


³¹P NMR in CD₃CN (+10% (v/v) propanol)

Network Design and Synthesis



BAPO (1-2wt%)



A protected hydroxyethyl phosphate triester monomer bearing two terminal alkene groups enables network formation via **thiol-ene mediated crosslinking**.

Outlook

- Optimize **thiol-ene crosslinking** to enhance network formation and maximize gel fraction.
- Investigate **degradation** through small-molecule kinetics and network studies to determine optimal breakdown conditions and rates.
- Explore **terminal alkene epoxidation** for the development of epoxy-based network formulations.
- Develop and characterize **coatings for metal substrates** with a focus on adhesion and corrosion resistance

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References

1. Majumdar, S. *et al.* **Macromol.** 2021, 54, 7955–7962

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