

Mechanochromic thermoplastic elastomers doped with pyrene

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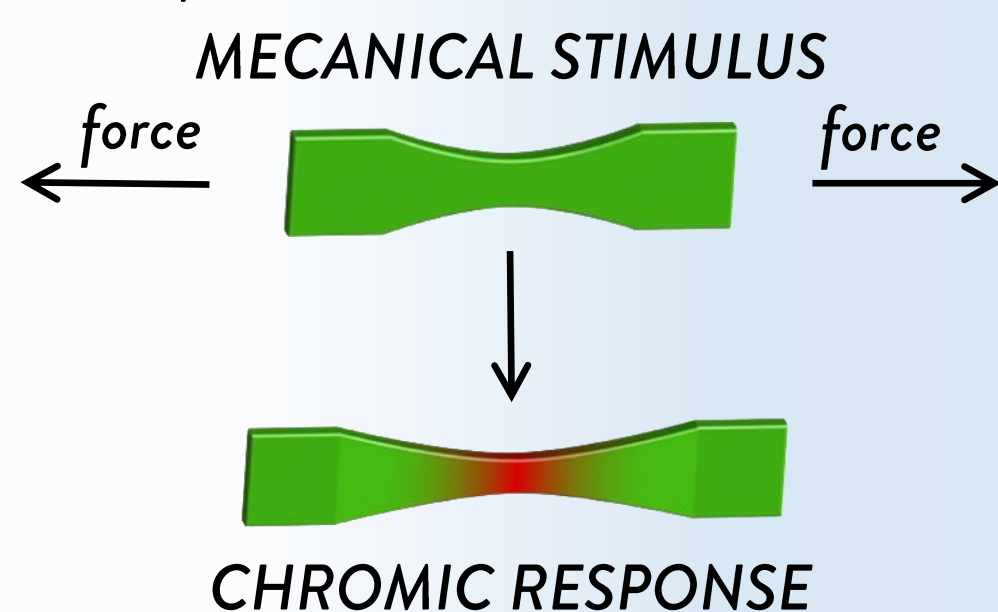
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Introduction and Sample Preparation

Mechanochromic polymers change their optical properties (in emission and/or absorption) under mechanical stimuli.



Evidence of degradation and/or solicitation could be easily detected also **without using complex apparatus**.

Pyrene chromophore is one of the most exploited aggregachromic probes of external solicitations.

Pyrene, in a rigid matrix, forms excited-state dimers (**excimer**).

Different emission properties between monomers and excimers.

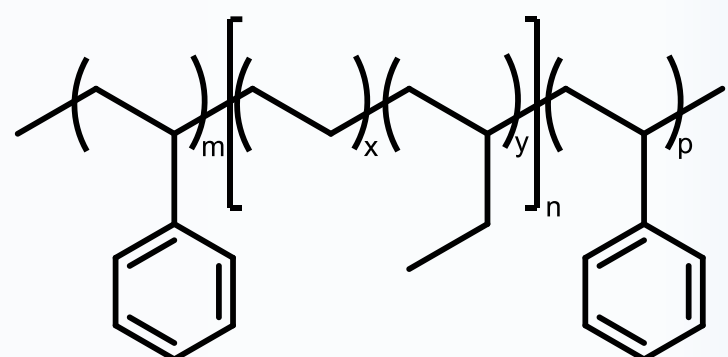
The **aggregates** can easily be broken by temperature or mechanical stresses.



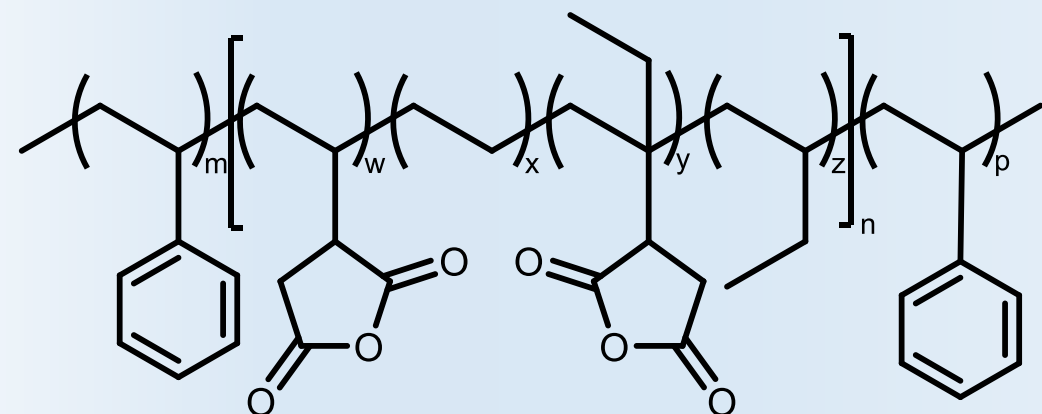
The goal is to use pyrene in combination with thermoplastic elastomeric matrices for **the development of smart chromogenic materials** with a reversible mechanochromic response.

Pyrene could be **dispersed** into the polymer or **covalently linked**.

SEBS
(styrene-*b*-[ethylene-co-butylene]-*b*-styrene)

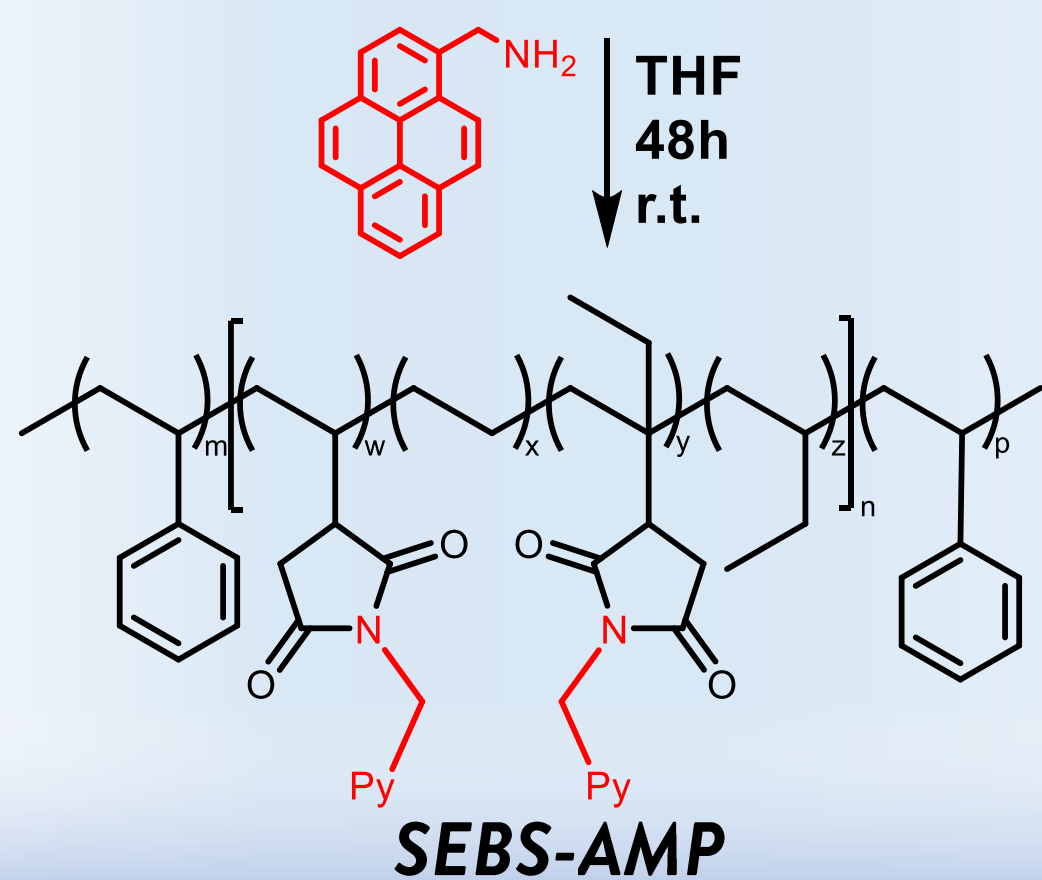


SEBS-g-MA
(succinic anhydride ≈ 1 wt.%)



The polymeric film has been obtained by compression molding. SEBS has been employed with different amount of **dispersed pyrene** (1%, 2.5%, 5% and 10%).

For SEBS-AMP the amounts of AMP **linked** to the polymer has been determined by UV-Vis analysis (≈0.7 wt.% of pyrenic units).



Sensors, 19, 4969, (2019)

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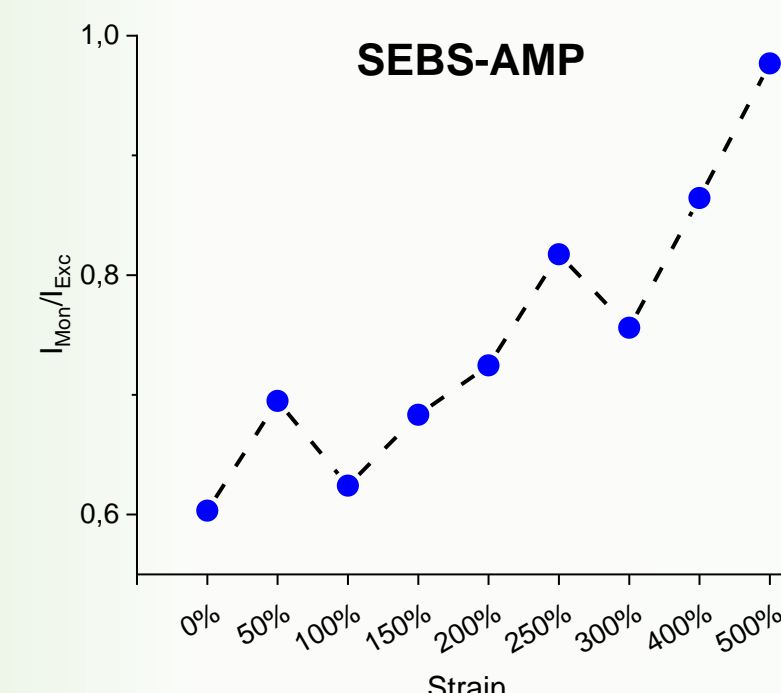
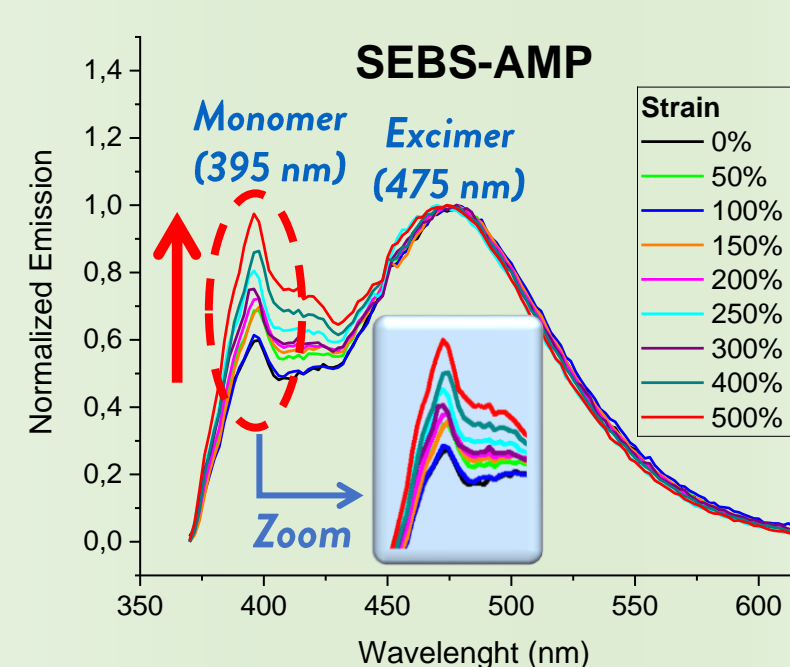
Macromol. Chem. Phys., 221, 1900463, (2020)

References:



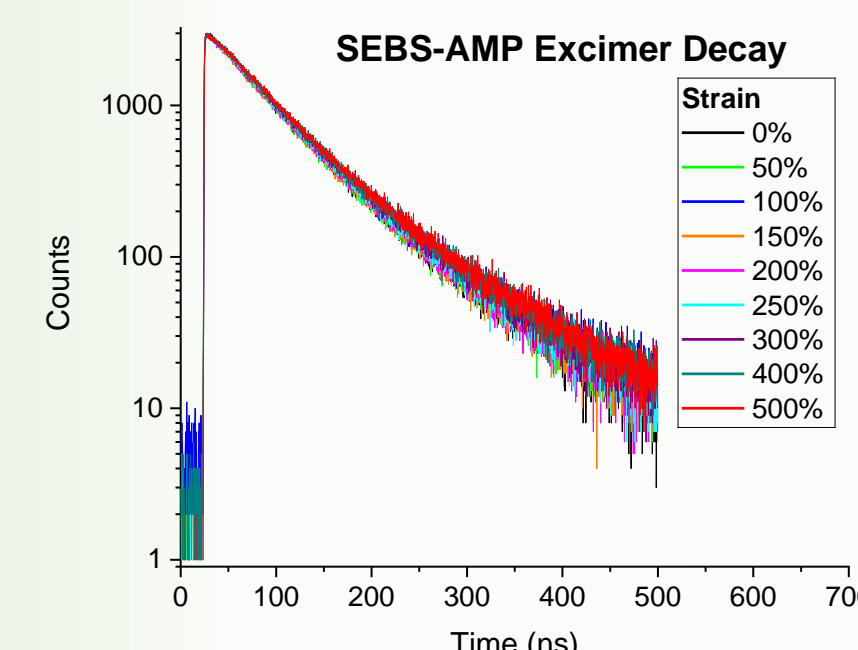
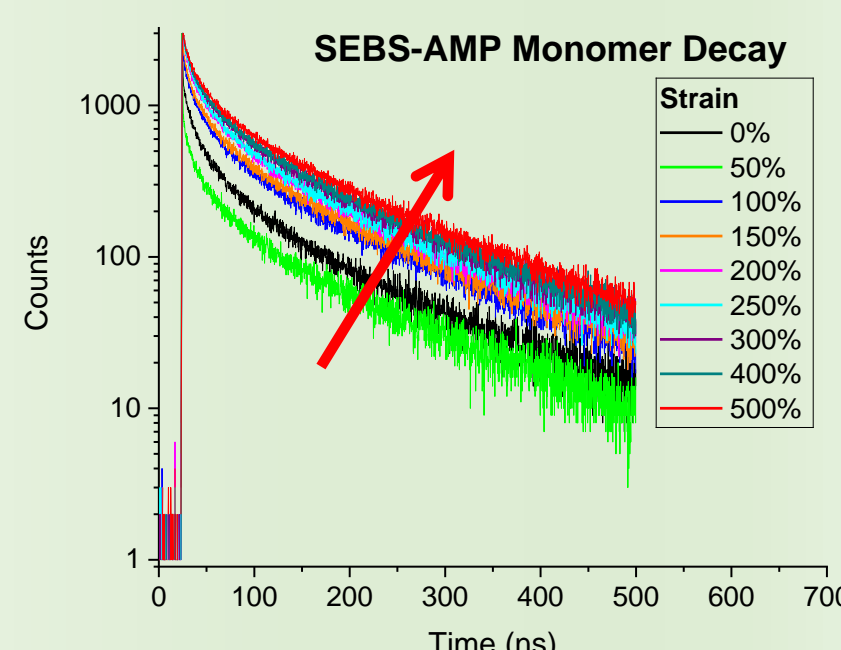
Experimental Data

For SEBS-AMP an increase of $I_{\text{Monomer}}/I_{\text{Excimer}}$ has been observed with increasing deformation.

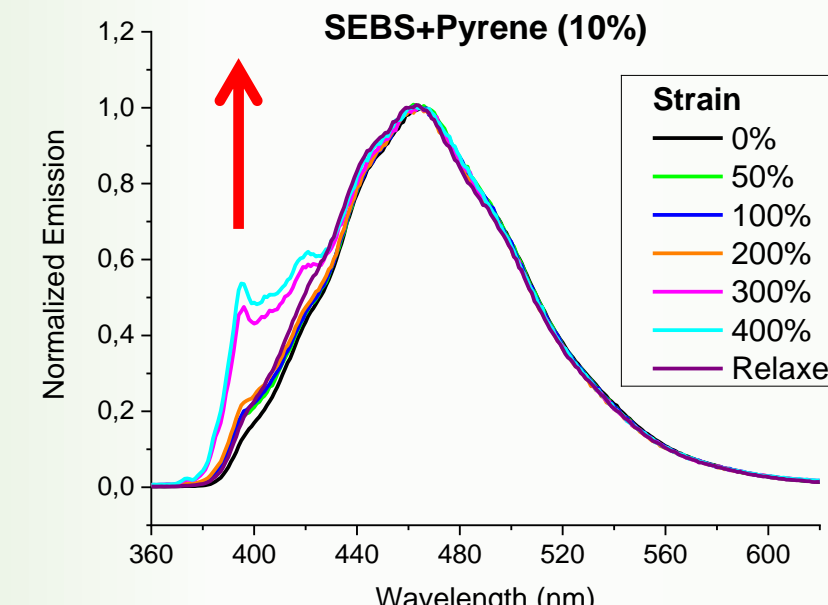
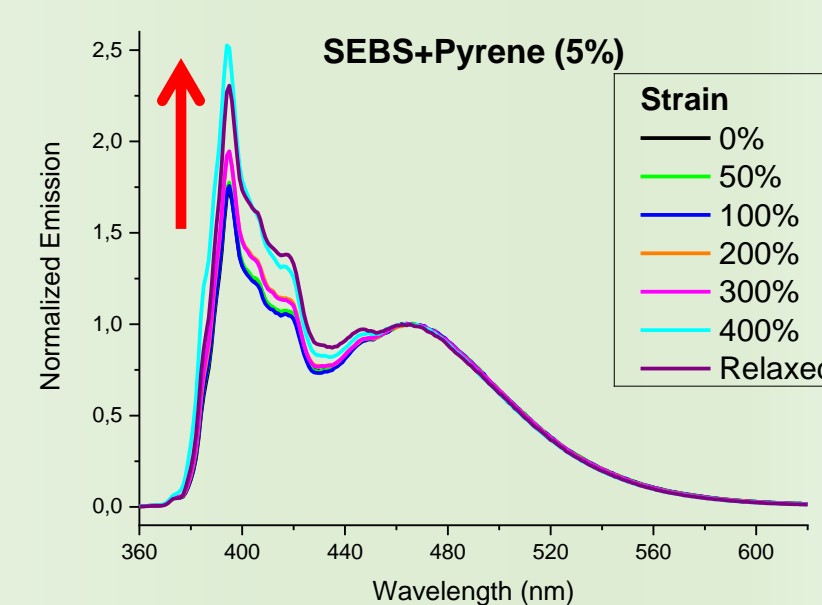


In SEBS-AMP, the deformation also increased the lifetime of monomeric emission (pyrene units are moved away from each other due to the external deformation and the aggregation becomes more difficult).

On the contrary, the lifetime of excimer emission remains unchanged during the deformation.



For film containing physically dispersed pyrenes, the excimeric band appeared at concentration higher than 5%, only. The mechanochromic response appeared mostly similar to the covalent approach.



For physical dispersion, polymeric film lifetime measurements are in progress.

In both physically dispersed or covalently linked formulations, the systems show a good reversibility in the optical response.

Stress-strain tests demonstrate that dispersed or linked pyrene has a small impact on the mechanical properties of the polymeric material.

