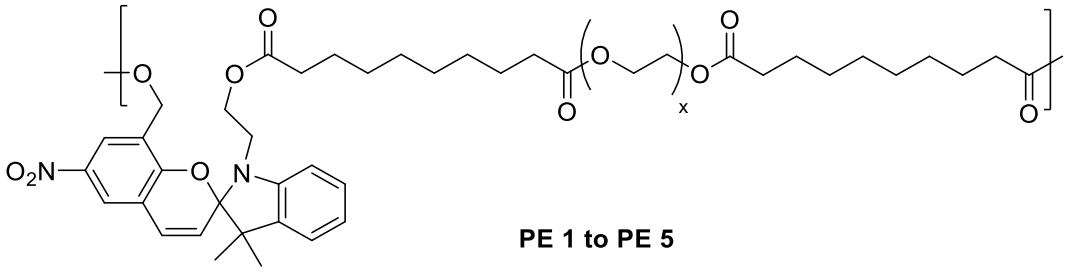
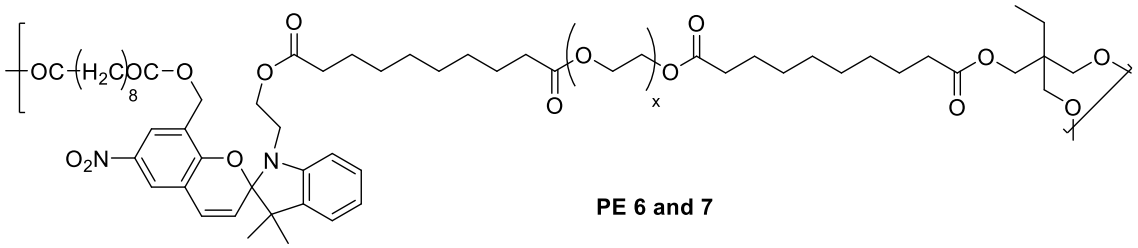
CLAIMS

1. A thermophotochromic polymer comprising two or more spiropyran units or derivatives thereof, wherein the polymer is configured to reversibly change its absorbance characteristics upon an application of thermal energy and/or ultraviolet light and wherein the polymer comprises at least one structural unit selected from the following:

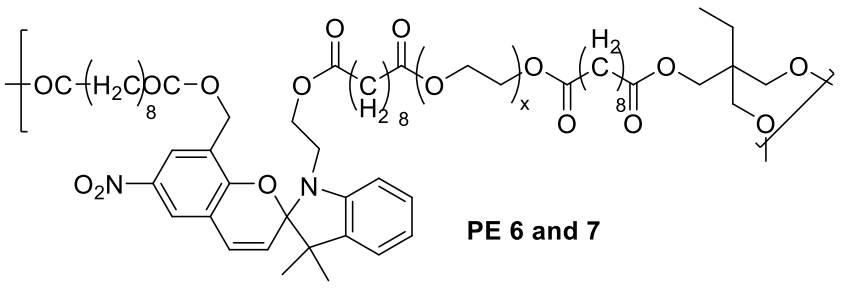


PE 1 to PE 5

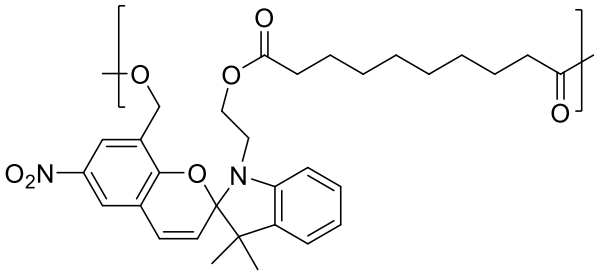


PE 6 and 7

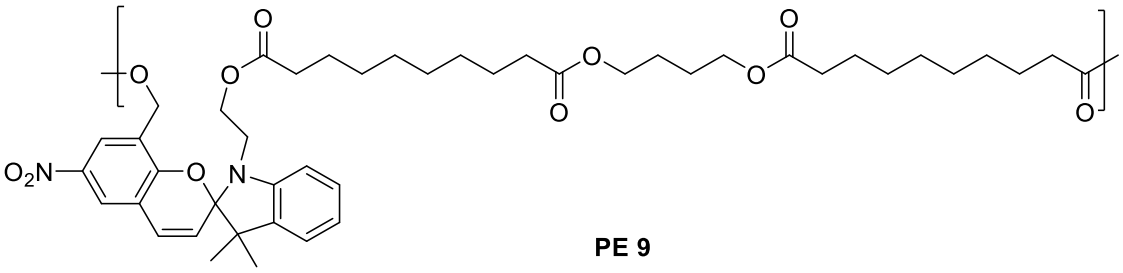
Or



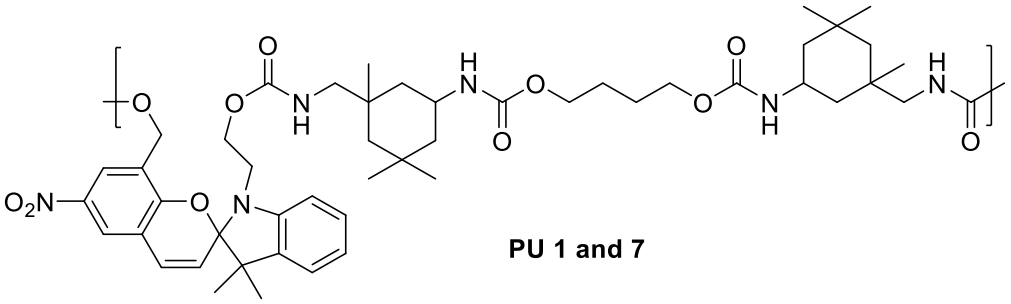
PE 6 and 7



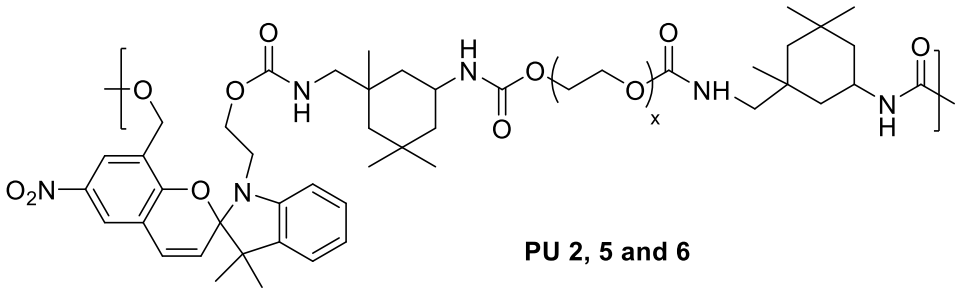
PE 8



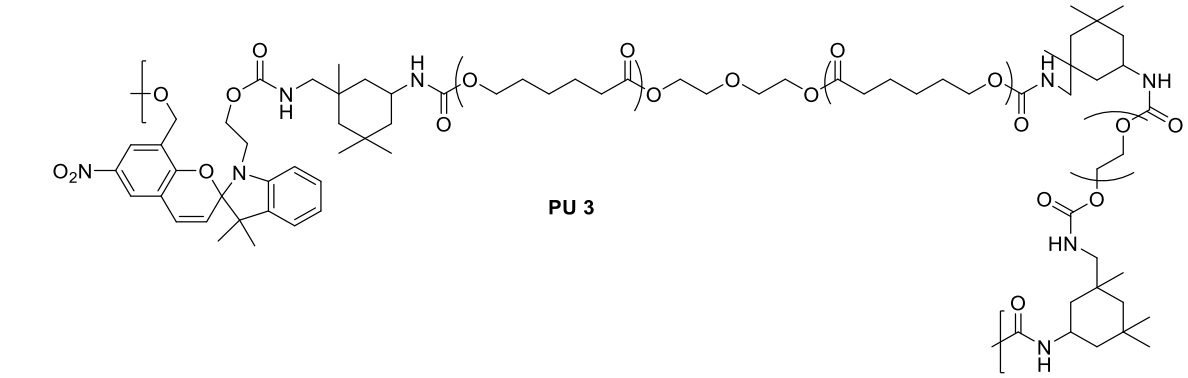
PE 9



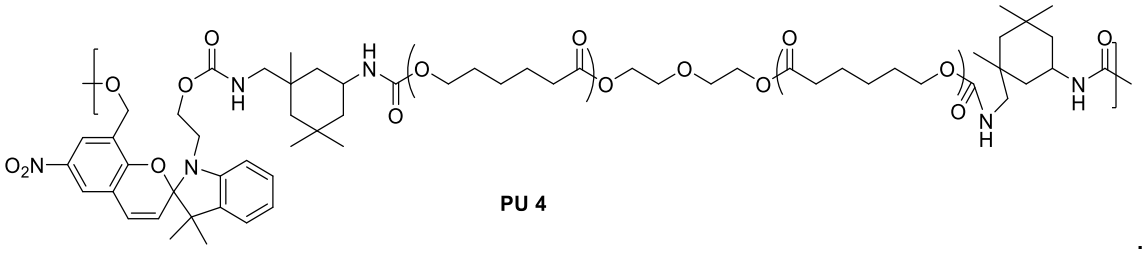
PU 1 and 7



PU 2, 5 and 6



PU 3



PU 4

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2. The thermophotochromic polymer of claim 1, wherein an application of thermal energy facilitates a change in absorbance characteristics in a same direction as an application of ultraviolet light.

3. The thermophotochromic polymer of any one of the preceding claims, wherein an application of visible light facilitates a change in absorbance characteristics in an opposite direction as an application of thermal energy and/or ultraviolet light.

4. The thermophotochromic polymer of any one of the preceding claims, wherein the polymer changes from a lighter colour to a darker colour upon application of thermal energy and/or UV light.

5. The thermophotochromic polymer of any one of the preceding claims, wherein the polymer is configured to further reversibly change its surface wettability characteristics upon an application of thermal energy and/or ultraviolet light.

6. The thermophotochromic polymer of any one of the preceding claims, wherein an application of thermal energy and/or ultraviolet light result(s) in the ring opening of the spiropyran units or derivatives thereof in the polymer.

7. The thermophotochromic polymer of any one of the preceding claims, wherein an application of visible light facilitates ring closing of the spiropyran units or derivatives thereof in the polymer.

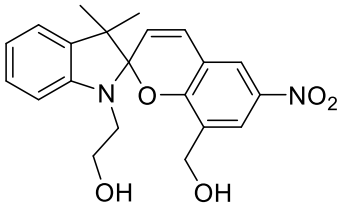
8. The thermophotochromic polymer of any one of the preceding claims, wherein the polymer is present at a concentration of from 0.01 wt% to 50.0 wt% in solution.

9. The thermophotochromic polymer of any one of the preceding claims, wherein the polymer is soluble in a solvent.

10. A method of preparing the thermophotochromic polymer of any one of the preceding claims, the method comprising: reacting one or more spiropyran diol with one or more compounds selected from the group consisting of dicarboxylic acids, dicarboxylic acid derivatives, diacid chlorides, diisocyanates, diisocyanate derivatives, isocyanate derivatives, multifunctional carboxylic acids such as trifunctional carboxylic acids, polyfunctional carboxylic acids, monofunctional and multifunctional carboxylic acid derivatives such as difunctional carboxylic acid derivatives, trifunctional carboxylic acid derivatives, polyfunctional carboxylic acid derivatives, multifunctional isocyanates and multifunctional isocyanate derivatives, and optionally with one or more alcohols selected from dihydroxy, trihydroxy and polyhydroxy.

11. The method of claim 10, wherein the spiropyran diol is reacted with the compounds in a molar ratio of from 1:1 to 1:30, and optionally with the alcohols in a molar ratio of from 1:1 to 1:30.

12. The method of any one of claims 10 to 11, wherein the spiropyran diol is represented by Formula II:



Formula II

13. The method of any one of claims 10 to 12, wherein the one or more alcohols is/are present and is/are selected from the group consisting of C_2 to C_{10} diol, oligomeric and polymeric ethylene, propylene glycols and combinations thereof.

14. The method according to any one of claims 10 to 13, wherein the method comprises reacting one or more spiropyran diol with one or more diisocyanates selected from the group consisting of hexamethylene diisocyanate, tetramethylene diisocyanate, cyclohexane diisocyanate, tetramethylxylene diisocyanate, dodecylene diisocyanate, tolylene 2,4-diisocyanate, tolylene 2,6-diisocyanate, isophorone diisocyanate, their derivatives thereof and combinations thereof.

15. The method according to any one of claims 10 to 14, wherein the method comprises reacting one or more spiropyran diol with one or more diacid chlorides selected from the group consisting of adipoyl chloride, dodecanedioyl chloride, succinyl chloride, sebacoyl chloride, heptanedioyl chloride, isophthaloyl chloride, terephthaloyl chloride, trimesyl chloride and combinations thereof.