Service life estimation for a polymeric solar absorber.

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Abstract

The work presented in this thesis is devoted to the development of a methodology for estimation of the service life in a polymeric solar absorber used in a glazed collector. The higher temperature in this kind of collector put strong demands for polymeric materials, thus studies about the deterioration of the absorber during service life became a key factor for the introduction of this technology in the solar thermal industry.

Understanding the evolution of the technology and the possible future scenarios in the solar thermal industry may help to the reader to understand the relevance of this work. How polymeric material may impact this tendency is discussed in chapter 1.

The thesis is focused in a particular polymeric collector as a base to develop the necessary tools for estimation of the service life of the polymeric solar absorber; however the methodology may be extended to similar polymeric solar absorber or even other polymeric products that may have similar demands during service life. Chapter 2 discus the particular conditions of the polymeric collector studied in this work.

Deterioration of the polymeric solar absorber during service life has been characterized by the mechanical responds of the absorber sheet. An indentation test was developed to quantify this. A brief introduction to the indentation test is given in chapter 3; Paper 1 explains the details of the proposed procedures as well as the reliability of the test.

The methodology for estimation of the service life has been based in the damaged caused by the thermal degradation in the solar absorber. To study the impact of the different conditions in the absorber sheet, the indentation test is then applied to specimens with different temperatures and exposure times. A model is proposed to estimate the service life of the solar absorber. Chapter 4 explains the model and give an example of its implementation in four different solar systems. Details of the model are discussed in Paper 2.