

SUMMARY

New approaches and opportunities in photovoltaic field rise need for new characteristics like flexibility and lightness. Traditional solar panels are not able to meet those requirements due to heavy and rigid glass cover. Current master thesis investigated the feasibility of using commercial polymethyl methacrylate (PMMA) and polycarbonate (PC) as a frontsheet cover of semi-flexible solar panel for marine applications.

Literature review on this topic revealed promising characteristics and examples on implementation as well as problematic properties of PMMA and PC such as high water vapor transmittance, high thermal expansion and low adhesion to other materials. High thermal expansion of PMMA and PC induces stress in the solar panel that in turn cause curving of the whole structure. Experimental part indicated that curving can be reduced by symmetrical configuration of solar panel layers. Adhesion strength measurements showed insufficient adhesion strength between untreated PMMA and encapsulant material ethylene-vinyl acetate (EVA), but satisfactory strength between untreated PC and EVA. Flame treatment and chromic mixture etch managed to improved the adhesion strength for PC, however only UV treatment improved the adhesion strength for PMMA. Investigation of polymers surfaces included measurement of surface free energy and surface roughness to determine the prerequisites of a good adhesion with EVA. Surface free energy measurement can determine the increase of polar component, which strongly affect the adhesion strength of PMMA. PC adhesion ability is not easily determined as it does not behave similarly to PMMA. Overall, surface free energy and roughness do not produce reliable and consistent connection with peel test adhesion strength.

According to this work, PMMA seemed to be more prospective as a frontsheet of a semi-flexible solar panel mainly due to its high transmittance. Further attention is needed on post-lamination curving and environmental test.