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Assessment of the recovery of photovoltaic cells cutting fluid by chemical pretreatment and ultrafiltration

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ABSTRACT

The main objective of the work was to regenerate a cutting fluid HS20 used in the manufacturing of silicon wafers. Centrifugation at ambient temperature is initiallyconsidered for the treatment of the cutting fluid HS20. However, the slurry being heavily loaded with mineral colloids, tests conducted following the use of this process, have proved its efficiency to be low. Indeed, the best results for colloidal matter abatement have never exceeded 30%. By contrast, an ultrafiltration through a polyethersulfone membrane with a cutoff of 1 kDa shows excellent efficiency and affinity towards the fluid (HS20) to be considered, allowing its full recovery by maintaining its original cutting fluid characteristics. However, this process does present some drawbacks. A strong resistance to flow across the membrane of up to 60% of the total resistance is observed and a drop in permeation flux of about 90% are observed. Given these results, reinforcement of ultrafiltration, under the same operating conditions, by chemical pretreatment is considered. Chemical pretreatment with ultrafiltration offers better regeneration efficiencies under same flow conditions through the membrane as compared to an ultrafiltration process. Indeed, the fouling index is significantly reduced to around $153 \times 10^{3+}\,s/L^2$ and a permeation flux comparable to that observed for virgin cutting fluid (HS20) is obtained.

Keywords: Cells; Cutting fluids; Regeneration; Photovoltaic; Pretreatment; Ultrafiltration

1. Introduction

The photovoltaic (PV) industry is going through a rapid phase of growth. In 2006 alone, the global PV production was over 2 GW. The majority of PV cells are made of silicon, which is mainly produced during the energy-intensive Siemens process. As per the current status, the wafer shares more than 65% of the

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