

## 1. Abstract

With the increasing energy demand around the world, global warming, and the continuous decrease in fossil fuels reserves, there is growing interest in many countries towards renewable, clean and sustainable energies. Most of the photovoltaic solar cells use various crystalline and amorphous structures of silicon as its semiconductor element. These can be obtained using silane as a precursor. Silane is commonly synthesized as a result of the disproportionation reactions of trichlorosilane, in a process involving two reactors and various separation units. However, the unfavorable chemical equilibrium presented in the previous reaction system causes a substantial recycle ratio, which consequently signifies high investment and energy costs. Hence, previous studies have designed and proposed a reactive distillation column scheme as an alternative to the conventional process to produce silane. This arrangement takes advantage of the chemical characteristics of the disproportionation reactions and the significant distinction of the boiling points of their components. An intermediate condenser within the rectification zone of the reactive distillation column was incorporated later in this proposal to alleviate the refrigeration load of the overhead condenser. The optimal design and operating conditions for this RD with intermediate condenser have been evaluated under steady-state conditions. This paper aims to study the dynamic behavior of the formerly explained system, working in a multitask mode to produce silane, monochlorosilane, and dichlorosilane, with high purity, by adequately switching the operating conditions. Three different control strategies were tested against perturbations on the intermediate condenser's refrigeration duty and the associated side stream. The results showed that the best configuration implies a LV, dual temperature control. This set up was capable of producing the three products with a purity equal to, or higher than, 99.5% and allowed successful stabilization of the system after the tested perturbations. Additionally, a proposal for controlling the rectification zone temperature with the refrigeration load of the intermediate condenser was built and tested.