# CHAPTER I
# INTRODUCTION

During the last decade, the price difference between lower alkanes and their corresponding olefins has significantly widened in the international markets making the catalytic dehydrogenation of lower alkanes an attractive alternative for commercial applications. The widening of the price difference has been driven by a growing oversupply of lower alkanes in comparison with a substantial increase in the demand for lower olefins. The rapid growth of the demand for lower olefins is generating alternative routes not based on by-products of petrochemical or refinery processes.

Dehydrogenation of light alkanes has a great industrial importance because it represents an alternative for obtaining alkenes for polymerization and other organic synthesis from low cost saturated hydrocarbon feedstocks.

Catalyst systems that employ platinum or tin on neutral supports have been reported to exhibit high dehydrogenation selectivity and catalyst stability for dehydrogenation of light paraffins at elevated temperature. Alumina supported platinum catalysts are widely used in several hydrocarbon processes. Several studies have proved that the addition of tin to $Pt/Al_2O_3$ catalysts is known to promote the desired reaction. It accelerates the dissociative adsorption of the alkane, which is thought to be rate limiting, reduces the rate of coking, increases the coke tolerance and faciliates the gasification of coke.

A very important requirement that a material must meet to be an effective support for alkane dehydrogenation catalysts is that it must have low acidity. At the high temperature required for the lower alkane

dehydrogenation processes, the acidity of the support promotes undesired side reactions such as isomerization, cracking and coke formation.

Alkali ions are usually employed to neutralize the acidity of the support and thereby minimize undesirable reactions.

This project concentrates on the effect of lithium on the decoking performance for propane dehydrogenation over $Pt-Sn-Li/Al_2O_3$ catalysts. Each spent catalyst with different lithium loadings was studied. The long term study investigated the regeneration performance during multiple reaction-regeneration cycles. The coke on the metal and on the support after the first reaction cycle was characterized by TPO and was compared with that found after the eighth reaction cycle. For the short term studies, the coke on different lithium loaded catalysts was partially burned off at various burning times with analysis of the gaseous effluent during burning and then they were characterized by Elemental analyzer (CHNS/O), Simultaneous thermal analysis (STA) and Infrared (IR) spectroscopy.