

# A Modified State Independent Function For Surface Energy Over The Whole Liquid Range

Mohammad Hadi Ghatee, Afsaneh Maleki

Department of Chemistry, Shiraz University, Shiraz, 71454

E-mail: ghatee@sun01.susc.ac.ir

## ABSTRACT

We explore the correlation between reduced surface tension and reduced temperature that have been developed and worked out recently. The general relation will be considered more fundamentally based on behavior of density profile of liquid- vapor coexisting curve. The correlation is characterized by the persistent linear behavior from freezing point up to the critical point. The slope of the correlation is a universal constant for those hydrocarbons for which surface tension data are available from freezing point to the critical temperature. We will discuss that since the slope is universal among hydrocarbon, quantitatively it must belong to a fundamental property of the system, which could demonstrate law of corresponding states. We have derived an analytical form from the slope and show that it is accurately constant  $\approx 1$  from freezing point up to the critical point. We have applied the critical exponent  $\mu = 1.26$ , however, the critical exponents that are derived from available experimental data are different. The application of derived  $\mu$ , however, would not bring about appreciable differences in the result given by  $\mu = 1.26$ . The relation for the slope leads to a new form of relation surface energy, involving the critical exponent and the relation to the generic nature of surface entropy is pursued.

Keywords: Surface Tension; Surface Energy; Surface Entropy; Critical Exponent

## INTRODUCTION

The surface tension of a fluid is of interest for both theoretical and practical interest. Practically it is needed for reactor design and when the flow of normal and liquid metal are involved. In studying mixture of dense liquids, the process of mixing is not only ordered by the molecular interaction but also it is governed by the change in the interfacial free energy, which is a function of surface tension at the interface of the mixing partner. These plus many other applications make the surface tension a valuable tool in studying the thermodynamic of liquids. We

examine correlation that consists of the reduced surface tension as a unique linear function of the characteristics reduced temperature scaled distance from either boiling or critical temperatures. The correlation was nicely consistent with the law of corresponding states and inputs the surface tension of the substance at the freezing temperature. We further improve the basics of the correlation using the temperature dependence of the surface tension including the critical exponent of the surface tension. We present a simple relationship which is pretty well state independent and comes up