CHAPTER I
INTRODUCTION

There are four common methods to measure interfacial tension or surface tension. They are Du Nouy ring, Wilhelmy plate, sessile or pendant drops, and capillary rise methods (Miller and Neogi, 1985). Du Nouy ring and Wilhelmy plate are the methods that determine surface tension by measuring the vertical force acting on a solid body, a horizontal circular ring for the former method and a vertical plate for the latter method, during its withdrawal from a liquid. A major problem in employing these two methods is to set the plate vertical or the ring horizontal during measurements. It is more complex for the latter method because the force on the ring due to the meniscus is not perpendicular to the surface at most position of the ring. In sessile and pendent drops methods, surface tension is determined from dimensions of static drops, which are often measured from photographs. One of their limitations is that only the contact angles at the point, in which the meridian plane intersects the three-phase line, are reflected from the camera or video. Both methods work well for low surface tensions in liquid-liquid systems (Kwok *et al.*, 1996).

The classical capillary rise offers a technique to overcome those problems with possessing a low operating cost with higher accuracy than the other methods (Kwok *et al.*, 1996). Even though the capillary rise method has been widely used to determine surface tension, it has problems that entail its experimental setup. Since the diameter of the capillary tube must be very small in order to provide capillary force to draw liquid into the tube, it is, therefore, rather difficult to align the tube in an exact-vertical position. On the analysis, the Young-Laplace equation is used to characterize the capillary rise technique (Miller and Neogi, 1985). It relates the surface tension to the liquid height by treating the contact angle is zero, i.e., the meniscus shape is hemispherical. To approach such the condition, the capillary tube must be clean, smooth and homogeneous. These are problems that capillary rise technique has inherited. Capillary rise in annulus is then of interest because this technique does not rely on the tube size due to the liquid rises into a small gap between an inner and outer tubes.

An important mediator of corrosion that facilitates the transport of the electrochemical species for corrosion (e.g. salt) is water. Aluminum rivets and screw fasteners appear to be sites perpendicularly susceptible to corrosion with the presence of water in those small gaps. This problem has been observed, for example, in the fuselage of some aircraft, with significant implications for the lifetime of the plane. It has been suggested that capillary forces draw water into gaps between the rivet or screw and the facing surface. Aluminum surface is to be modified to retard or prevent the corrosion by means of minimization of the water uptake.

As mentioned how important capillary rise is, the aim of this study was to distribute an account of the static interface that makes up the fundamental understanding of the capillary rise in annulus. Measurements of interfacial tension by this method were carried out and compared to that obtained from cylindrical capillary tubes. The studies of the static interface can then lead to the understanding of dynamic interface, which can be used to elucidate the corrosion problems.