The subject of metal/metal ion electrode behaviour has been drawing considerable interest in the recent past. Within this broad area, investigations have focussed on the kinetics of anodic oxidation mechanisms, initial oxidation state of the anodic oxidation product or on the application of anodic generation of metal ion to coulometric analysis. Anodic oxide films on metals form an important ingredient of modern technology, industrial processes related to electronic devices, dielectric and insulating materials, capacitor technology, fuel cells, batteries, etc.

Most of the workers, in later 1950's, have put forward several theories of ionic conduction mechanism under high field strength through anodic films on valve metals. Not much has been done in the field of dielectric and electrical behaviour of such films. The aim of the present investigation is to carry out a detailed study of the properties — electronic, electrical and dielectric — of anodic oxide films alongwith their ionic conduction behaviour. Superpurity aluminium has been used for this purpose because it has been reported in the literature that impurities in a metal considerably affect the leakage current of electrolytic capacitors and properties of the oxide films. Results, presented and discussed in various chapters, will be useful to the solid state chemists towards ultimately standardizing the techniques for capacitor technology and thin insulating films.