

Preface

This book has been initiated by my former colleague, Mr. Anil Kumar Senior Principle Scientific Officer at National Physical Laboratory, who put to me some questions regarding the calibration of viscometers. I also realised that understanding of viscosity and viscous forces have been a subject matter of interest to research workers in many fields like medicine, oil industry, to physicists, chemists, engineers, fuel technologists and to rheologists.

Absolute measurement of viscosity of liquids even with 0.5 % accuracy is rather a tough and time-consuming job. On the other hand, measurement of viscosity relative to viscosity of some standard has been much easier and uncertainty involved is much less than 0.1 %. Hence it becomes necessary to have liquid of known viscosity. Easy availability of water of known characteristics and density to very high degree of accuracy makes it a correct choice to be the primary standard of viscosity. Therefore, the measurement of viscosity of water has been emphasised. Some scientists have spent a major part of their working life in viscosity measurement of water. For example, Scientists at NIST USA have spent some 20 years to establish the value of viscosity of water. The measurement of viscosity of water by capillary and oscillations viscometers has been discussed in [Chap. 8](#) of the book.

Once the value of viscosity of water is established, the next valid step is to build the viscosity scale. This has been discussed in [Chap. 2](#) of the book. Uncertainty propagated to the n th step of viscosity scale has also been derived. Corrections necessary to apply to viscometer constant of the viscometer when used at different temperatures with a different liquid in establishing the viscosity scale have been discussed in detail.

Keeping the popularity of capillary viscometers in mind turbulent and streamline flow has been given. Expression for kinematic viscosity in terms of efflux time and dimensions of the capillary viscometer is established. It has been observed that the kinetic energy correction given in different documents vary in the numerical factor which causes a lot of confusion. Different numerical factors used in the kinetic energy correction are due to use of incoherent units. This point has been amply discussed in [Chap. 1](#).

The rotating and oscillating viscometers along with the viscometers used in specific fields have been discussed in detail. New trends based on modern physical principles like use of PZT crystal, Optical fibre shear waves and Love waves have

been discussed to meet the inner hunger of the researchers in the field. Availability of commercial viscometers, advantage of specific type viscometers have been discussed for the convenience of the users.

It is my pleasant duty to thank my former colleagues at NPL such as Mr. Anil Kumar who along with Mrs. Reeta Gupta has helped me provide all the literature and scientific papers. I need to gratefully acknowledge the help of Dr. Ashok Kumar who has gone through my write-up and advised me on viscometers based on ultrasonic and shear waves PZT crystals. Nothing will be enough to thank Dr. Habil Claus E. Ascheron my Editor at Springer, without whose help and guidance it would have been impossible to get this book published.

Delhi, India, 14 October, 2013

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Viscometry for Liquids

Calibration of Viscometers

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2014, XV, 256 p. 81 illus., 3 illus. in color., Hardcover

ISBN: 978-3-319-04857-4