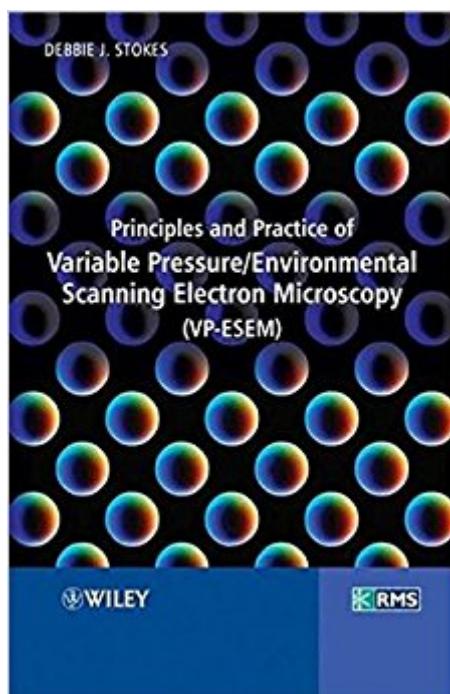


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# Principles And Practice Of Variable Pressure: Environmental Scanning Electron Microscopy (VP-ESEM)



## Synopsis

Offers a simple starting point to VPSEM, especially for new users, technicians and students containing clear, concise explanations Crucially, the principles and applications outlined in this book are completely generic: i.e. applicable to all types of VPSEM, irrespective of manufacturer. Information presented will enable reader to turn principles into practice Published in association with the Royal Microscopical Society (RMS) -[www.rms.org.uk](http://www.rms.org.uk)

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Scanning electron microscopy (SEM) is a technique of major importance and is widely used throughout the scientific and technological communities. The modern SEM is capable of resolution on the order of a few Angstroms (i.e. sub-nanometer), subject to the limits of electron-specimen interactions. However, for a long time it has been apparent that the high vacuum SEM needed to develop in respects other than increased resolution. Hence the advent of SEMs that utilise a gas for image formation while simultaneously providing charge stabilisation for electrically non-conductive specimens and/or a suitable environment for materials and experiments involving water. This text outlines the principles and applications in a generic way, applicable to readers familiar with any of the types of VP-ESEM on the market, irrespective of manufacturer The book addresses various aspects of the topic in six chapters. Chapter 1 - A brief historical overview contains background information charting the development and growth of the technique and its underlying principles Chapter 2 - Principles of SEM gives an overview of various aspects of the conventional high

vacuum SEM, in preparation for later chapters covering the greater variety of operating conditions associated with the VP-ESEM. Chapter 3 - General principles of VP-ESEM: utilising a gas reviews the basic scientific principles of signal formation and collection in a gaseous environment, including specimen stability as a function of water vapour pressure and/or temperature. Chapter 4 - Imaging and analysis in the VP-ESEM: the influence of a gas looks at the properties and effects of different gases, pressures and primary electron energies, with particular attention to electron scattering and its effects on imaging and microanalysis. Chapter 5 - Imaging uncoated specimens in the VP-ESEM briefly looks at the pros and cons of putting native-state materials in the VP-ESEM, such as primary electron beam penetration, radiation damage and, crucially, the properties of materials in an electric field and the influence of gaseous positive ions. Chapter 6 - A lab in a chamber → in situ methods in VP-ESEM and other applications concludes the book with a survey of dynamic experiments such as: tensile testing, vapour-deposition of nanostructures, oxidation and reduction, lithography, ice crystallization and wetting of surfaces, to name a few, as well as unique imaging methods, plus an extensive review of the literature covering both hard and soft materials. This book is intended as a guide to help those that are just starting out with VP-ESEM, as well as those with more experience looking to gain a deeper appreciation of the concepts.

For anyone who is looking for a book on the principles and practice of variable pressure in environmental scanning electron microscopy, you can't go wrong with this book. In fact, this may be exactly what you need.

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