Valve-regulated Lead–Acid Batteries

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Preface

For over a hundred years from its conception, the lead–acid cell was normally operated with unrestricted access between the surface of its electrolyte and the external atmosphere so that, during periods of overcharge, hydrogen and oxygen were lost from the cell via electrolysis. As a result, periodic additions of distilled water were necessary. Since about 1970, an alternative to the traditional 'flooded' cell has been available — one that avoids the need for water maintenance. Moreover, acid is immobilized in the new design and this endows the cell with the additional advantages of being 'spill-proof' and able to operate in any orientation (upright, on its side, or even upside down).

The change to the so-called 'valve-regulated lead–acid' (VRLA) technology has not, however, been accomplished without some difficulty. Experience has demonstrated forcibly the fundamental differences between the two systems, and the lead–acid battery manufacturing industry has faced major challenges in investing the VRLA version with a performance to match that of its flooded predecessor. Nevertheless, research into understanding the electrochemisty, producing improved cell components and optimizing charge strategies has resulted in VRLA batteries becoming well-established and reliable devices. Operators now take advantage of the particular properties of these batteries for the storage of electrical energy in a wide variety of stationary applications.

Much of the recent advancement of VRLA technology has been achieved through a co-operative research effort under the auspices of the Advanced Lead-Acid Battery Consortium (ALABC). The main effort has been directed towards the development of VRLA battery systems for new-generation road transportation — electric and hybrid electric vehicles — that will reduce fuel consumption and lower emissions. The progress gained in this endeavour will ultimately also benefit the enormously important markets in telecommunications and remote-area power supplies.

This volume presents a detailed account of recent advances in the science and technology of VRLA batteries. The expert contributors are from organizations which have either been members of, or contractors to, the ALABC. In editing the contributions, we have aimed to unify the style of the volume as far as possible, but have allowed a little overlap between those chapters where there is a natural interaction between topics. It is hoped that this work will constitute a sound exposition of the present status of VRLA batteries, and will provide a resource that will enable technologists to deliver products with performances that surpass the requirements of the major markets.

We wish to express our special appreciation of the dedication and expert skills of Ms. Rita Spiteri (CSIRO) for producing the complete text for publication and redrafting most of the illustrations.

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