International Aluminium Institute

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Alumina Technology Roadmap

Executive Summary

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It is now well recognized that aluminium is a leading material for the expanding global economy, especially in terms of its versatility and sustainability. Alumina is the essential feedstock for producing new aluminium.

In the late 1990s the aluminium industry produced a vision for its future and technology roadmaps to achieve that vision. In addition to a generic roadmap, the industry developed roadmaps related to inert anodes and advanced smelter technology, the use of aluminium in automotive markets, the handling and treatment of bauxite residue, and the use of advanced ceramics to improve aluminium production and processing. The first edition of the *Alumina Technology Roadmap* was published in November 2001 and represented the last significant portion of the production chain to be addressed.

The alumina industry continues to face similar issues as most other global commodity producers: social and environmental reporting, the challenge of sustainable operations, the image of a 'green' industry, and competition from substitute materials. Individually each producer is addressing these challenges. However, some challenges are best dealt with by an industry sector above and beyond the direct competitive environment. One key outcome of a technology roadmap is identifying these collaborative areas and the steps that must be taken to achieve the industry-wide goals.

Roadmaps should be living documents that periodically need updating as technology developments change industry sectors in different ways. Hence an updated Aluminum Industry Technology Roadmap was issued in February 2003. Experience over the past four years in implementing the outcomes of the original *Alumina Technology Roadmap* clearly pointed to the need to review its contents and produce an update. This ensures the document does communicate the future needs of the industry, focus the efforts of diverse groups such as public research laboratories, supplier companies and the universities on critical issues, and align the interests of all stakeholders.

In producing the original *Alumina Technology Roadmap* the essential first step was the development of critical technology goals to which the industry should aspire. These ambitious goals establish the long-term vision and encompass the challenges for alumina as a commodity — energy efficiency, safety, environmental performance, sustainability issues, and customer expectations — as well as the product challenges of quality, consistency, and performance. The goals reflect the industry's acknowledgment of the growing impact of environmental and social issues on business practices. Improving overall performance on environment, health, and safety, for example, will push the industry beyond current best practice and enhance its long-term competitiveness. These strategic goals are just as valid today as they were four years ago.

The original roadmap identified six major themes encompassing the highest-priority research and development needs identified by the industry. These themes were:

- Bayer process chemistry and alternatives,
- resource utilization,
- energy efficiency,
- process and knowledge management,
- residue treatment and reuse, and
- safety/human exposure.

A major objective of the original roadmap was to help alumina companies align their pre-competitive research programs with the needs of the global alumina industry. The hope

was that the research agenda described in that roadmap could be pursued by both individual companies and collaborative partnerships within the industry, as well as help guide government participation. Individual companies could develop a better understanding of how their own strategic plans mesh with the priorities of the industry as a whole. The roadmap should also serve as a mechanism to better educate suppliers to the alumina industry about its needs and integrate them into collaborative R&D activities in areas such as process sensors and materials of construction. There are already tangible examples of suppliers developing innovative solutions to the alumina industry's problems – a positive outcome from the original roadmap.

However, it is fair to say that developing collaborative research projects out of the roadmap has been a challenging exercise. It took longer than expected for the industry to agree on appropriate research topics. Scoping individual topics was a slow process. Other factors that came into play were the challenges of driving a collaborative model in a competitive industry, difficult communication within companies because of changing roles, and maintaining a consistent core of industry champions during a time when the industry underwent major rationalizations.

Two significant developments have recently prompted a desire by the industry to revisit and revise the roadmap such that it receives a greater impetus to move forward. First, the International Aluminium Institute has constituted a Bauxite & Alumina Committee (BAC), and secondly the Alumina Technical Panel (ATP), comprised of the R&D Managers of the five major alumina producers in Australia, has undergone a new lease of life.

The alumina industry can greatly improve the efficiency of its research efforts by sharing the costs of mechanisms already in place. Individual companies can benefit by sharing research results, thereby increasing the industry's collective knowledge and avoiding duplication of efforts.

Similarly, the sharing of best practices among refiners can benefit all areas of plant operation as well as environment, health, and safety aspects. In many cases technologies existing in other industries may offer solutions to alumina industry problems. Examining other industries' responses to scale management, ore beneficiation, and waste heat recovery, for example, could help refiners develop their own solutions to these problems. Application of best practices from other industries may represent the best pathway for industry needs that are considered low risk yet have potentially high payoff.

As stated in the original roadmap, implementing the research activities in the updated roadmap will require a substantial effort on the part of the alumina industry to increase corporate spending on R&D, handle complex intellectual property issues and overcome other difficulties and costs involved in developing and demonstrating new technology.

The alumina industry should make renewed efforts via the BAC and the ATP to move forward with the research priorities in the roadmap so that it can begin to reap the benefits. New technologies that can lower costs, decrease energy consumption, reduce environmental impact, and improve worker health and safety will help ensure the industry's continued health and prosperity well into the 21st century.