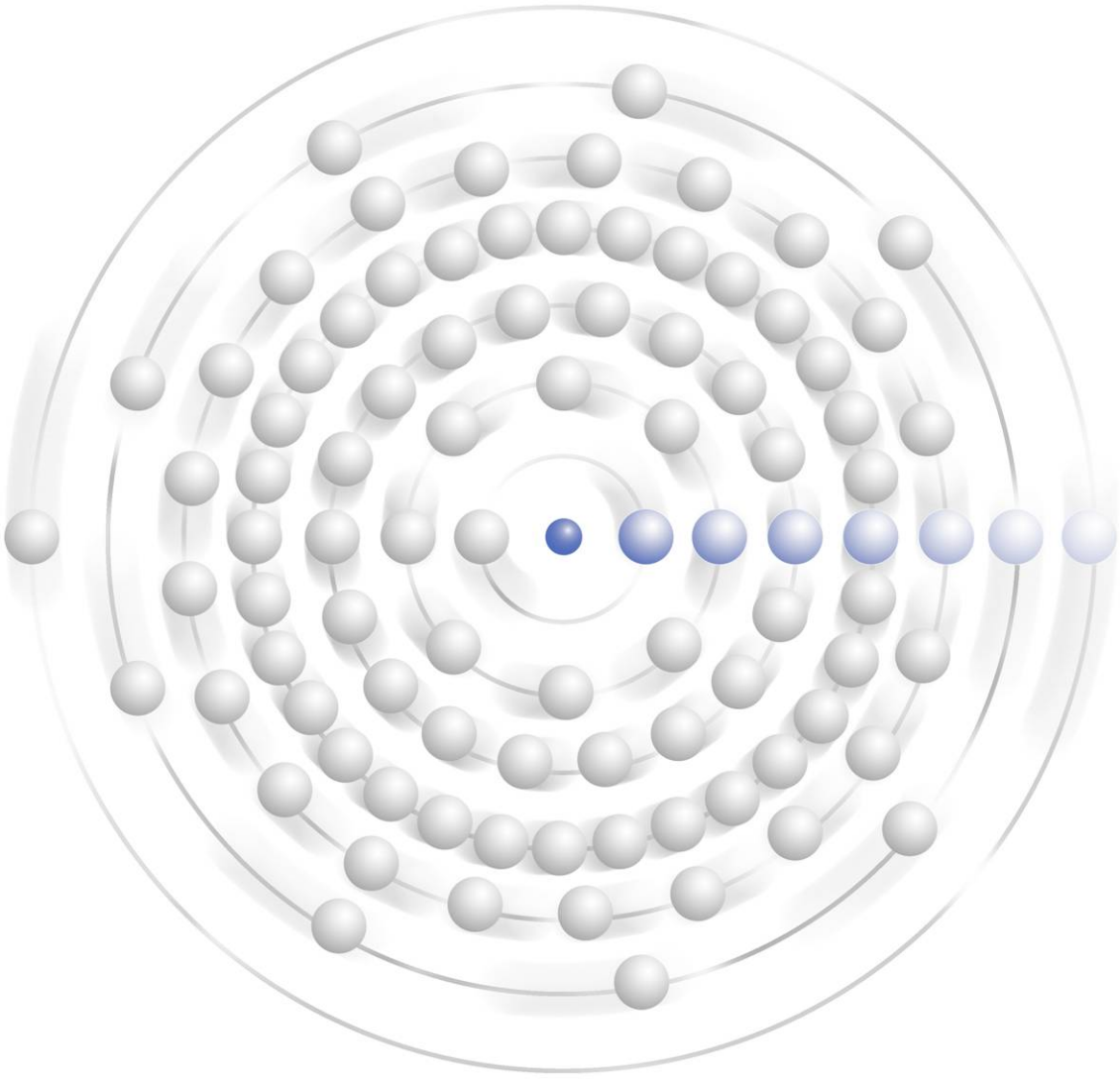
Ux Consulting Services **April 2010**

Nuclear Zirconium Alloy Market



A service of

UxC®

Ux Consulting
1401 Macy Drive
Roswell, GA 30076
(770) 642-7745
www.uxc.com

Table of Contents

List of Figures

List of Tables

1 – Introduction & Overview

In November 2008, The Ux Consulting Company (UxC), a leading nuclear fuel market consultancy, published a Special Report on the Nuclear Zirconium Alloy Market. That report was intended to be a one-of-a-kind snapshot of the contemporary zirconium alloy industry.

However, the highly favorable response to that original report convinced us that there was a need and desire for an update and expansion of that effort. That has been accomplished and our latest findings and conclusions are presented herein.

Nuclear-grade zirconium alloys and components are employed in the fabrication of fuel assemblies used in the vast majority of nuclear reactor designs currently operating, under construction, and planned around the world. As the nuclear renaissance takes hold to varying degrees in countries all over the globe, many questions about the international nuclear fuel supply chain have arisen. The supply of nuclear-grade zirconium alloys – from the mining of zircon mineral sand through the manufacture of cladding and components used in finished fuel assemblies – has not escaped this scrutiny. Therefore, the primary objective of this report is to factually and analytically approach the current and expected future direction of the nuclear-grade zirconium alloy market to help arrive at some clear conclusions about how producers of fuel assemblies for nuclear reactors will obtain the necessary zirconium alloys for their finished products.

This updated report offers UxC's most recent analyses and opinions of the various sectors that make up the nuclear-grade zirconium sponge, alloy, materials, and tubing markets. Additional details are included on the interplay of the nuclear fuel fabrication and the zirconium alloy supply markets. We then identify major trends in this unique industry by analyzing the global, regional, and selected country supply and demand balances for nuclear-grade zirconium alloy and tubing. We conclude with some final observations on the global market as well as expectations for future price developments for the related zirconium alloys and tubing.

Availability of Data

During the preparation of the original report, it became clear that, in general, the various processors and fabricators of nuclear-grade zirconium sponge, alloys, and fuel assembly components were reluctant to publish or even discuss the details of their businesses. Much of their information is considered proprietary and thus restricted from inclusion in reports such as this. Consequently, in the prior report, there were some gaps in the data.

It has been suggested that one reason for this reticence is the concern among zirconium alloy producers and processors that with the expected increase in demand resulting from the nuclear renaissance, new competitors might decide to enter the nuclear-grade zirconium business.

Nonetheless, in the period since the original report was published, we have been able to develop additional sources and to fill in a number of the blanks. Thus, we believe that this report provides a significantly more comprehensive and more accurate picture of the industry than the earlier document.

To supplement the data collection process, we provided each of the principal processors and producers with a draft of the portion of the report that described their operations. If corrections were received, the appropriate changes were made in the text. If our data were confirmed, or if no response was forthcoming, the original language, based on the best information available from public and private sources, was used. Where possible, we confirmed data from one source with a second, independent source.

We believe that this information is accurate or at least representative of the operations, production levels, etc. of the companies discussed in the succeeding chapters of the report. However, the possibility still exists that there may be some errors or that the information has changed since the data were obtained. In a few cases, there were no available non-proprietary data, and, therefore, the missing information is listed as "not available" in the affected data tables.

Another significant improvement on the previous report is the demand analysis and forecasts for zirconium alloy and tubing. This new report incorporates detailed UxC calculations of the zirconium weight and tube content in all the major nuclear fuel assemblies in the world. Moreover, the forecasts presented in the report make use of UxC's recently developed UxC Requirements Model (URM) to forecast global reactor fuel loading requirements and consequent demand for zirconium alloy materials and products. The URM projects demand on a reactor by reactor basis taking account of each plant's refueling schedule (and/or construction schedule for new plants), the specific fuel assembly design used in that plant, the size of the reload batch (or initial core), and the zirconium-alloy content of the fuel assemblies. This has resulted in a far more accurate presentation than that used previously.

Structure of the Report

This report includes separate chapters for various aspects of the nuclear-grade zirconium alloy market, supply and demand, and other related areas. Following this **Chapter 1 – Introduction & Overview**, the report includes:

Chapter 2 – General Zirconium Overview provides a broad summary of the zirconium mineral occurrence, resource base, and industrial applications, including the role of zirconium alloy production for the nuclear fuel industry. This discussion helps to put the specific nuclear-grade zirconium alloy market analysis in better perspective, as there are numerous applications for the zirconium mineral beyond nuclear reactor fuel. Additional discussion is provided on the broader global market for zircon and how this impacts the specific nuclear-grade zirconium alloy market.

Chapter 3 – Manufacturing Processes for Nuclear Fuel Cladding discusses the manufacturing processes and the overall "zirconium cycle" for production of the materials and components used in nuclear fuel assemblies.

Chapter 4 – Nuclear Zirconium Alloy Materials & Product Suppliers offers a profile of each of the companies involved in nuclear-grade zirconium alloy materials and product supply. This includes all the companies in the world involved in zirconium sponge and alloy production and processing through manufacture of sheet, plate, bar stock, and tube-reduced extrusions (TREX), as well as tubing and other component manufacture.

Chapter 5 – Nuclear Fuel Fabricators & Zircaloy Tubing Supply provides a brief overview of the global nuclear fuel fabrication business and indicates the source of each fabricator's fuel assembly tubing and other components.

Chapter 6 – Nuclear Zirconium Supply & Demand Analysis offers UxC's analysis of the global supply and demand balance for nuclear fuel-related zirconium alloy products. In addition, this chapter includes regional breakdowns as well as supply and demand discussions for some of the key countries in the nuclear zirconium market. Finally, zirconium demand based on the different reactor types is also analyzed.

Chapter 7 – Overall Conclusions & Market Analysis completes our nuclear-grade zirconium market analysis with some final thoughts on the current situation and forecast of future trends, as well as current nuclear-grade zirconium alloy prices and expectations for future price developments.

A number of additional relevant items are included in the attached **Appendices.**

