



Further Indications of Iran's Renewed Interest in Maraging Steel for its Nuclear Enrichment Program

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A 2021 Atomic Energy Organization of Iran (AEOI) video and International Atomic Energy Agency (IAEA) reporting have revealed Iran's renewed interest in metal bellows in its advanced centrifuges. In the case of the IR-6 centrifuge, this interest may represent the development of a design change, since earlier Iran declared this centrifuge as having carbon fiber bellows. The most logical choice for the metal in these bellows, based on characteristics of gas centrifuges, is maraging steel.

Maraging steel bellows are well known to be used in the IR-2m centrifuge, but Iran has not made any of these centrifuges in years, leading to speculation that the bottleneck was the maraging steel.

Another indication that Iran is intensifying its interest in maraging steel in its centrifuge program is an early 2021 announcement of a translation of a Western textbook on maraging steel. Two researchers affiliated with Iran's Shahid Beheshti University translated a 2009 book about maraging steel, titled "Maraging Steels: Microstructure Modeling, Properties and Applications." The description of the book, part of the 2021 announcement on the website of Shahid Beheshti University, emphasizes properties that are examined, including "corrosion and mechanical properties," especially for use of maraging steel in the nuclear industry. It further highlights that the nuclear industry "requires more sensitivity and precision in the manufacture of parts used in this industry." Another part directly references the need to improve certain parts in the nuclear industry, possibly a direct reference to maraging steel centrifuge components: "The need to improve the quality of various parts in order to increase the efficiency of equipment, access to optimal production processes and reduce production costs, multiplies the importance of material design and its manufacturing process."¹

The book, originally written by United Kingdom-based Dr. Wei Sha and Dr. Zhanli Guo, is available in English language and was translated to Farsi by Dr. Noushin Yesaul and Dr.

¹ "Maraging steels were published," Shahid Beheshti University, March 11, 2021, [Google translated], <https://news.sbu.ac.ir/w/%D9%81%D9%88%D9%84%D8%A7%D8%AF%D9%87%D8%A7%DB%8C-%D9%85%D8%A7%D8%B1%DB%8C%D8%AC%DB%8C%D9%86%DA%AF-%D9%85%D9%86%D8%AA%D8%B4%D8%B1-%D8%B4%D8%AF>.

Seydamir Hossein Faqhi. It was edited by Mehdi Abbasi. Yesaul and Faqhi have also translated “An introduction to nuclear materials: principles and applications” together. According to a Fars News report from late 2021, Faqhi was appointed by AEOI-head Mohammad Eslami to lead the AEOI’s Institute of Nuclear Sciences and Technologies.² He has also written about radiation measurements.³ Yesaul has separately also written about uranium hexafluoride corrosion,⁴ vacuum technology, and explosive forming.⁵ Of the original British authors, neither appears to have a background in nuclear technologies, and neither the original English description of the book nor the authors’ preface cite nuclear as a main industry.⁶

This book may show an ongoing interest in maraging steel, as well as a recognition of problems confronting Iran’s nuclear industry. Given that the main use of maraging steel in Iran’s nuclear program is in centrifuges, this book may indicate a revived or intensified interest in using maraging steel in its advanced centrifuges.

The 2021 announcement and the English book, based on its table of contents, do not discuss the manufacturing of maraging steel, a difficult technical process that eludes many countries particularly with regard to the production of high quality, high grade maraging steel suitable for use in Iran’s advanced centrifuges. It remains a public mystery if Iran can make high grade maraging steel or if it has found a new international supplier willing to defy sanctions and trade controls. However, recent indications suggest one or both of these possibilities are occurring or are planned.

² “Seyed Amirhossein Faqhi became the head of the Research Institute of Nuclear Sciences and Technologies,” Fars News, November 27, 2021, [Google translated]

<https://www.farsnews.ir/news/14000906000883/%D8%B3%DB%8C%D8%AF-%D8%A7%D9%85%DB%8C%D8%B1%D8%AD%D8%B3%DB%8C%D9%86-%D9%81%D9%82%D9%87%DB%8C-%D8%B3%D8%B1%D9%BE%D8%B1%D8%B3%D8%AA-%D9%BE%DA%98%D9%88%D9%87%D8%B4%DA%AF%D8%A7%D9%87-%D8%B9%D9%84%D9%88%D9%85-%D9%88-%D9%81%D9%86%D9%88%D9%86-%D9%87%D8%B3%D8%AA%D9%87%E2%80%8C%D8%A7%DB%8C-%D8%B4%D8%AF>

³ Author page for Seyed Amir Hossein Faqhi, Elmnet.ir, [Google translated]

<https://elmnet.ir/author/%D8%B3%DB%8C%D8%AF%D8%A7%D9%85%DB%8C%D8%B1%D8%AD%D8%B3%DB%8C%D9%86-%D9%81%D9%82%D9%87%DB%8C>

⁴ Book page for “Corrosion of materials under UF6 gas,” Emalls.ir, [Google translated]

https://emalls.ir/%D9%85%D8%B4%D8%AE%D8%B5%D8%A7%D8%AA_%DA%A9%D8%AA%D8%A7%D8%A8-%D8%AE%D9%88%D8%B1%D8%AF%DA%AF%DB%8C-%D9%85%D9%88%D8%A7%D8%AF-%D8%AA%D8%AD%D8%AA-%DA%AF%D8%A7%D8%B2-UF6-%D8%A7%D8%AB%D8%B1-%D9%86%D9%88%D8%B4%DB%8C%D9%86-%DB%8C%D8%B3%D8%A7%D9%88%D9%84--%D9%86%D8%B4%D8%B1-%D8%AF%D8%A7%D9%86%D8%B4%DA%AF%D8%A7%D9%87-%D8%B4%D9%87%DB%8C%D8%AF%D8%B1%D8%AC%D8%A7%DB%8C%DB%8C~id~8736636

⁵ Author page for Naushin Yesaul, Elmnet.ir, [Google translated]

<https://elmnet.ir/author/%D9%86%D9%88%D8%B4%DB%8C%D9%86-%DB%8C%D8%B3%D8%A7%D9%88%D9%84>

⁶ The English version is available on Amazon at <https://www.amazon.com/Maraging-Steels-Microstructure-Applications-Engineering/dp/1845696867>.