

Trends in Induction Hardening

An Interview with Dr. Valery Rudnev, FASM, IFHTSE Fellow, Director of Science & Technology at Inductoheat, Inc.

Randy Stott, Managing Editor

We sat down recently with “Professor Induction,” otherwise known as Dr. Valery Rudnev of Inductoheat, to discuss trends in heat treating 2019.

Q: What heat treating technologies are helping gear manufacturers address the need for quieter gears?

A: There are numerous factors impacting noise characteristics of gears. Besides gear design, tooth profile, materials specification, etc., manufacturing of quieter gears is directly related to a minimization of a gear distortion after heat treating. However, in my opinion, what is EQUALLY important is the repeatability/consistency of the heat treatment results. Due to obvious reasons and based on the physics of the heat treatment process, there will always be a distortion (to different degree though) after heat treatment (phase transformations associated with heat treatment is one of the reasons

for that). A repeatable distortion can be compensated at previous operation steps of the manufacturing chain. There is a technical terms - Distortion Engineering or Distortion Management. The term of Distortion Engineering was originally proposed by Professor Peter Mayr from University of Bremen, Germany. Distortion Engineering requires the consideration of all process stages of the manufacturing chain in order to ensure a geometrical accuracy of the final product. If for whatever reason, it is inevitable to have size and shape distortion of gears after heat treatment, then an entire manufacturing chain should be analyzed and the most appropriate manufacturing step(s) should be selected to compensate for size and shape distortion of gears, racks with teeth, sprockets and other gear-like components after heat treatment.

Q: What are the newest advances in induction heat treating?

A: New technologies appear quite regularly. In the induction heat treatment area, technologies that probably made the most noticeable impact over the last decade were associated with the appearance of new semiconductors and developing novel medium- and high-frequency power supplies, as well as sophisticated high-speed monitoring and control systems. Advances in the design of tooling and fixtures have also made pronounced impact.

Q: How have changes in gear manufacturing technologies altered the heat treating requirements in recent years?

A: Induction heat treatment “does not like” sharp corners and sharp edges and other geometrical discontinuities and irregularities. It is beneficial to have appropriate radiuses to avoid an excessive local

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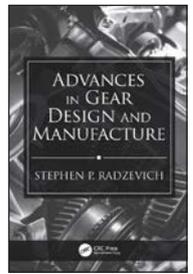
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heat generation within edge areas of the teeth. Therefore, gear manufacturing must take those features of electromagnetic induction into consideration. It is also important to have a sufficiently "friendly" prior microstructure (structure of parent material) when induction hardening gears and gear-like

components. It is highly desirable to use sufficiently homogeneous (both chemically and structurally without excessive segregation and severe banding) prior structures in applications where rapid induction heating is used. This will help to improve a consistency of induction heat treatment.

Q: How can gear manufacturers learn more?

A: A good place to start is the upcoming book, "Advances in Gear Design and Manufacture", by Dr. Stephen Radzevich. I contributed Chapter 10 of this book, and it's called "Induction Heat Treatment of Gears and Gear-like Components." 



Editor's note: The book will be available in June, but you can pre-order it now from CRC press: www.crcpress.com/Advances-in-Gear-Design-and-Manufacture/Radzevich/p/book/9781138484733

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One of the goals of induction heat treating for gears is developing highly repeatable, consistent results, so that distortion can be predicted and managed throughout the manufacturing process (image courtesy of Inductoheat).

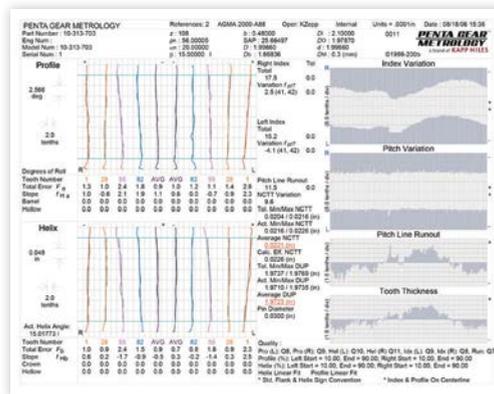
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