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Manufacturing and metrological characterization of reference specimens for indirect calibration of charpy impact test machines

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PRODIBIDO A REPRODUÇÃO

1. INTRODUCTION

The Charpy impact test is the most used when determining the toughness of metallic materials when dynamically requested. Its achievement requires the use of machines and measuring instruments calibrated, in order to obtain reliability and metrological traceability.

Charpy impact testing machines are calibrated using two methods: direct and indirect. The direct method consists of the physical evaluation of the machine, from the measurement of the components and verification of its functioning. The indirect method consists of the machine's functional evaluation through the performance of impact tests, using certified reference specimens, which are manufactured with a pre-assigned nominal energy [1].

These certified reference Charpy specimens are currently provided only by a few international research institutions, among them the National Institute of Standards and Technology (NIST) and Institute for Reference Materials and Measurements (IRMM).

The purpose of this article is to externalize the development of the methodology and procedure for the fabrication and metrological characterization of reference Charpy specimens, which is being implemented in the Mechanical Metrology Laboratory of the Institute for Technological Research (LMM-IPT), seeking to meet the technical standards relevant to the production of this reference material and quality. Thus, expanding the laboratory's scope of action and making IPT the supplier of this reference material in Brazil.

2. PROCEDURE

Based on research on methodologies applied by international institutes, like the ones mentioned above, for the manufacture of reference Charpy specimens, as well as methodologies studied in Brazil and related research, the main steps in the manufacturing process to be established in the LMM were defined. Studies were also carried out on the relevant standards that define the criteria for the manufacture of these reference materials, their evaluation and the infrastructure required by their producer.

After defining the steps of the manufacturing process, some sub-steps of metrological evaluations were inserted among them, such as, dimensional evaluations of all devices used, chemical analysis of the material used, dimensional evaluations of specimens after each machining step, metallographic and hardness evaluations after heat treatments and computed tomography evaluation of the finished product, with the objective of guaranteeing the homogeneity and quality of the specimens and the reproducibility in the manufacturing process.

The specimens are being manufactured by conventional mechanical machining and heat treatments carried out in laboratory ovens. The material used is Villares Metals V300MQA.

All steps of the manufacturing process and metrological evaluations meanwhile the production of specimens are being carried out by laboratories belonging to the IPT infrastructure. The attribution of nominal energies will be carried out in the National Institute of Metrology, Quality and Technology (INMETRO).

Figure 1 below shows a 3D illustration of the machining process for specimens and Figure 2 shows a specimen after machining and a specimen after heat treatment.

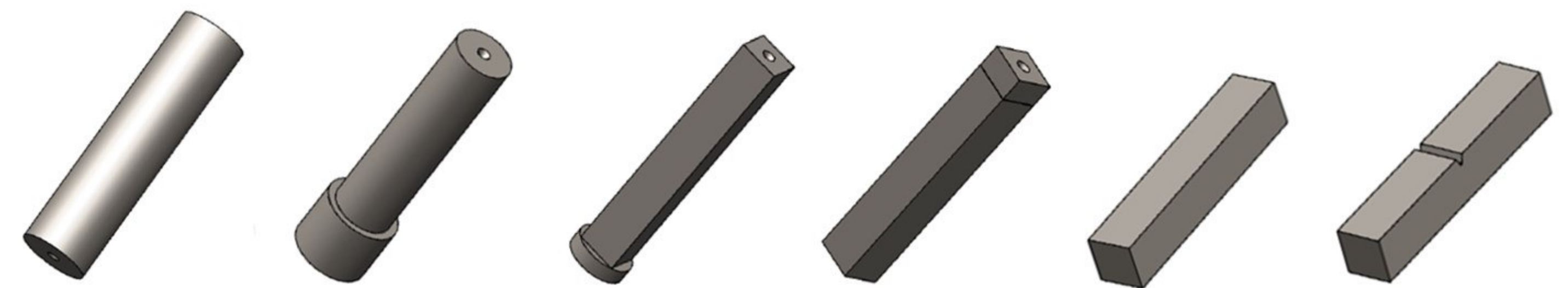


Figure 1. 3D illustration of the machining process for specimens.

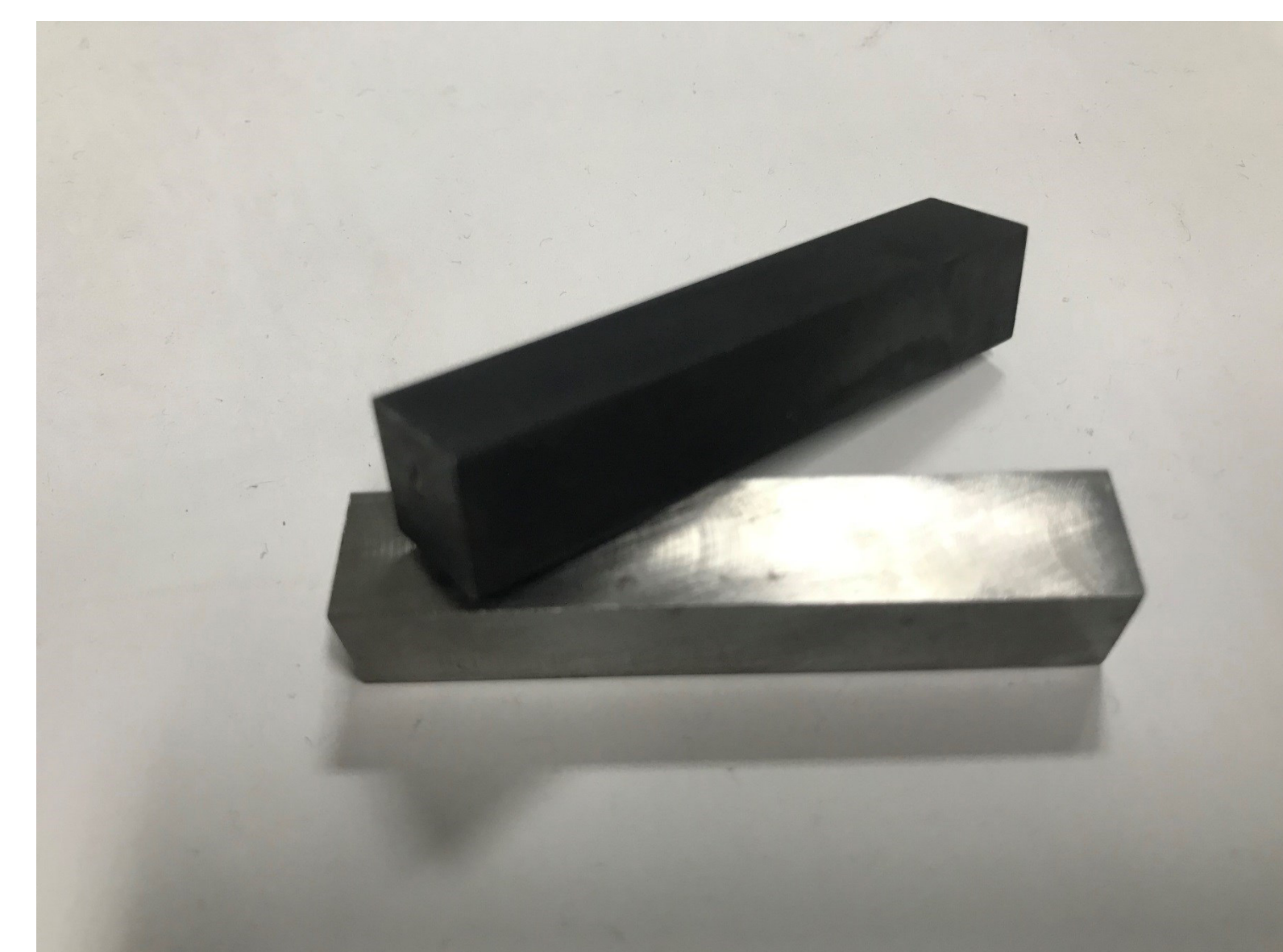


Figure 2. specimen after machining and specimen after heat treatment.

3. EXPECTED RESULTS

This project intends to institute a consistent methodology and manufacturing process in the IPT, which enable the production of specimens that meet the regulatory requirements and the necessary quality standards and thus provide traceability to the calibrations of Charpy impact testing machines, meeting the needs of the national industrial sector and contributing to the development of the testing and calibration sectors in the country.

4. ACKNOWLEDGMENTS

We would like to thank IPT, INMETRO and IFSP for their cooperation and support..

5. REFERENCES

- [1] - Metallic materials - Charpy pendulum impact test. Part 2: Verification of testing machines. ISO 148-2 (2016).
- [2] - Metallic materials - Charpy pendulum impact test. Part 3: Preparation and characterization of Charpy V-notch test pieces for indirect verification of pendulum impact machines. ISO 148-3 (2016).
- [3] "Standard Test Methods for Notched Bar Impact Testing of Metallic Materials". ASTM E 23-18a (2018).
- [4] - The NIST Charpy V-notch Verification Program: Overview and Operating Procedures. NIST, Materials Reliability Division (2003).