

INSIGHTS ON STATE-OF-THE-ART QUALITY CONTROL

Learn about the reproducible process of cutting a spark plug in half with no mechanical damage to the specimen surface .

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SPARK PLUG

PREFACE

Quality assurance is a critical process in automotive manufacturing. Quality control ensures customers receive products that meet their needs and are free from defects. If quality assurance processes are not supported by appropriate quality control procedures or these are done insufficiently or in the wrong way it potentially can put customers at risk.

Manufacturers are under constant pressure to meet market demands for safety, operational stability, environmental standards, and durability while at the same time improving productivity and remaining competitive in a global market.

At Struers, we aim to support manufacturers in meeting these demands in the global marketplace.

Our range of technology and expertise helps manufacturers prepare, analyze and ensure the highest quality of raw and processed solid materials in the manufacturing process.

In this materialographic report, we describe the procedure used to cut a spark plug in half, while at the same time minimising mechanical damage to the specimen.



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THE FIELD OF STUDY

Aligning, fixating, and cutting a spark plug for materialographic examination is challenging. It requires precise cutting to avoid mechanical damage on the specimen. We created a reproducible process to solve the challenges involved in making a precise longitudinal cut on a spark plug.

Two cut-off wheels were tested, trial cuts were made with and without a swivel shoe on the clamping device, and no significant differences were found. In the end, we proved that with the right technology and precision, the plug can be cut in half with minimal damage.



Exhibit 1: The final result from cutting a spark plug in half with minimal mechanical damage to the specimen.

Solution



REPRODUCIBLE PROCESS OF CUTTING A SPARK PLUG IN HALF WITH NO MECHANICAL DAMAGE

Cutting:



- Equipment: Secotom-50
- Cut-off wheel: MOD20
- Feed-rate: 0.04 mm/s

Clamping:

The first step involves clamping and positioning the spark plug with a vertical clamping tool and a dedicated vice as well as selection of the ideal wheel.

The vertical clamp (Cat. No. 05116905) is used on the right-side of the wheel to secure the vice to the cutting table. Trial cuts are made with and without the swivel shoe; no significant differences in the cut quality.

When positioning the spark plug, the connector end is positioned toward the wheel and the electrode end furthest from the wheel.

Wheel selection:

Metal-bonded 0.9 mm and 0.6 mm-thick diamond cut-off wheel (B0D20 and MOD20) were both tested with these specimens. The diamond cut-off wheel 0,6 mm thickness (MOD20) is more ideal for this application, given the cut surface, wheel thickness, and desired cut location.



Exhibit 2: Using a special clamping tool and dedicated vise. The use of swivel shoe on the clamp showed no significant differences in the quality of the cut.

Cutting parameters:

Next, precision cutting is done using the [Struers Secotom-50](#) and the 0.6mm diamond cut-off wheel (MOD20). Feed Rate is 0.04 mm/s with a rotational speed of 2200 rpm. If desired, the feed speed can be increased cautiously.

The cut length is 85 mm using the “Direct Cut” cutting mode. It is imperative with the chosen wheel to set the “Return Position” to Stay. This allows the wheel to finish the cut and stay in the final position.

Note that allowing the wheel to return to the start point or zero point could damage the diamond edge of the wheel.

It is useful to use an external cooling unit to prevent overheating during the cutting process. The standard Secotom-50 does not have an external cooling unit and relies on the cooling tank contained in the base of the cut off machine.

The additional external cooling kit is recommended for this application given the long cut due to spark plug geometry and slow feed rate to preserve the specimen surface and not damage the brittle ceramic components. During a series of cuts, the Secotom-50 did overheat and therefore would benefit from the additional external cooling unit.

Finally, a direct, 85 mm-long cut of the spark plug is made, starting from the connector end and leading toward the electrode end. Now that the cut has been made exactly in the middle without mechanical damage to the brittle ceramic components, the specimen is ready for further testing and analysis.

RESULT AND OVERVIEW

We created a reproducible method using automated equipment for cutting a spark plug in half – exactly in the middle - with no mechanical damage and a preserved specimen surface.

An accurate and precise cut can be made by selecting a suitable clamping device for fixation and a metal bonded diamond cut-off wheel with minimal thickness (0.6 mm).



Exhibit 3: The final result.

Solution



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