

## Morphologies of Cylinder Liner Surfaces of Today and for Tomorrow

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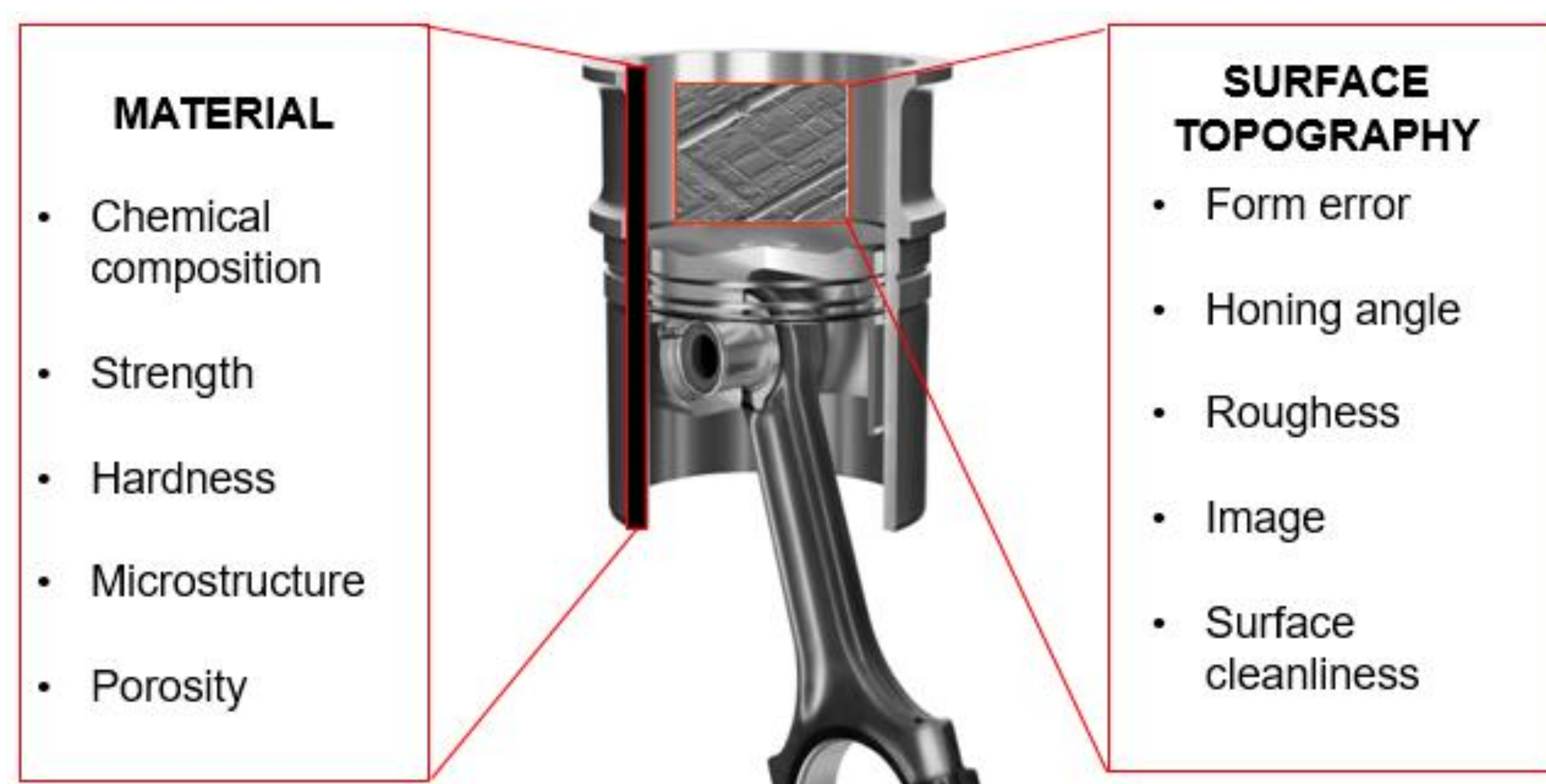
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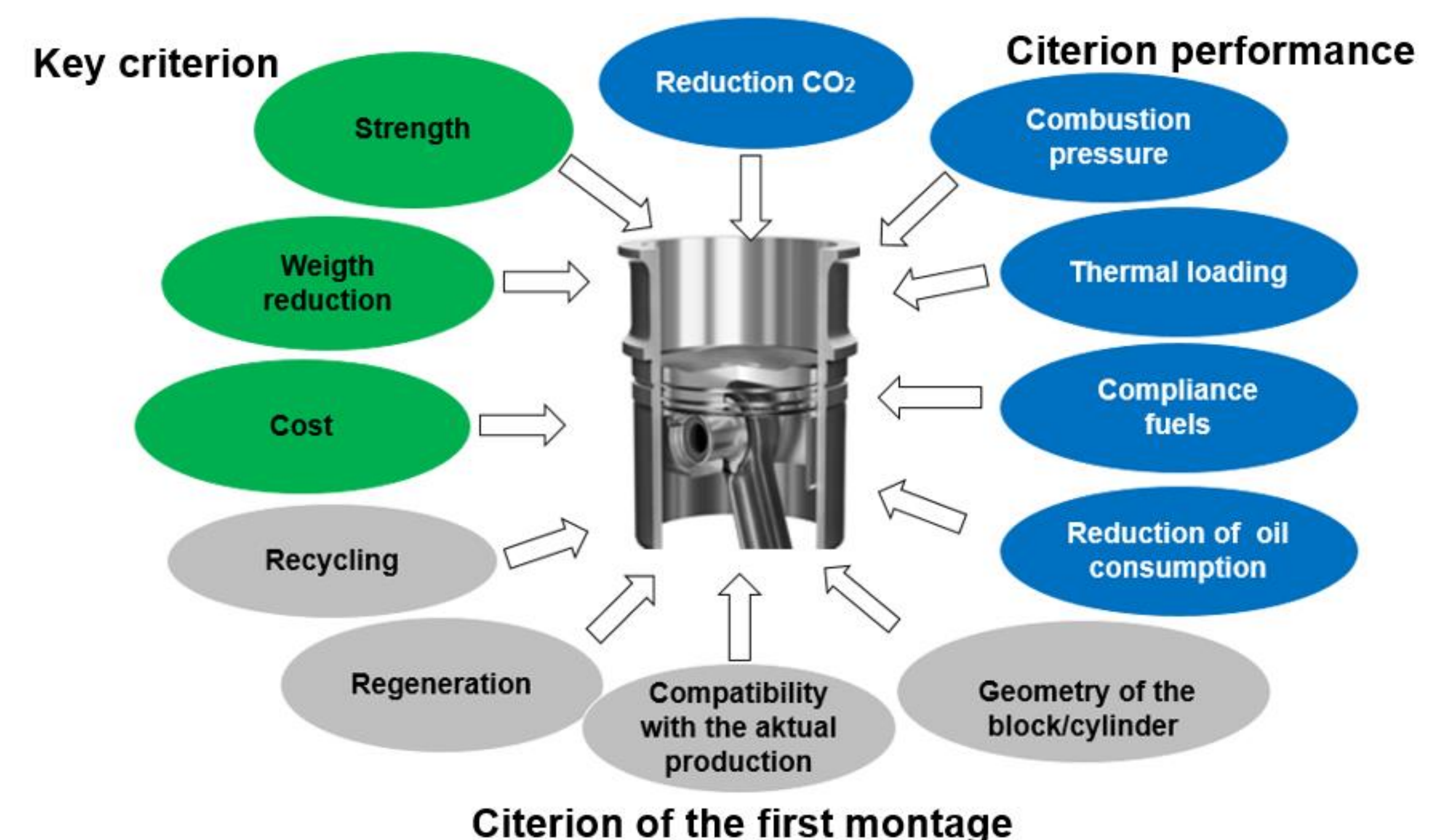
**Abstract:** In modern design of cylinder liners plays increasing role functional properties of the surfaces, its parametric definition and the possibilities of control. It is not only due to the new requirements of internal combustion engines in terms of growth combustion pressures, the reducing of oil consumption and emissions of toxic components in the exhaust but also because of globalization of manufacturing process over the world. Authors, based on personal experiences of some tens years in cylinder liners working for worldwide leader manufacturer for the one and tribological laboratory for the other one, are projecting in that paper new trends in surface topography that takes away in cylinder liner manufacturing. Evidently finishing machining as plateau honing (PH) and helical slide honing (HSH), are commented. The final finishing stage mainly used to generate plateau morphologies (with smooth plateaus and quite deep valleys) that look like to running-in surfaces and hence significantly reduce wear of the liner surface. The related topographical parameters and features that are essential to the functionality of the cylinder liner in the latest design solutions for internal combustion engines are discussed. Adopted parameters and functional characteristics of the material of the cylinder liner (chemical composition, ad hoc tensile strength, hardness and microstructure) and the geometrical characteristics of the cylinder liner (shape errors, cross-hatch angle, shaping the figure, the depth of deformation, surface roughness and surface cleanliness) are the result of the analysis tribological piston-crank system and the associated functions in the system during engine working operation. The article presents the results of research and analysis of the cylinder liners in context of roughness parameters 2D and 3D when using multi-stage treatment process smooth plateau honing in relation to simulation studies of oil film thickness and size of the forces of friction and motor tests in context of standards for pollution

**Keywords:** morphology invariants, cylinder liner, honing.

### FUNCTIONAL CHARACTERISTICS OF THE CYLINDER LINER IN THE SYSTEM PRC



### CURRENT REQUIREMENTS CRITERIE FOR CYLINDER LINERS



TECHNOLOGICAL PROCESS FLOW FOR CYLINDER LINERS	Today	REQUIREMENTS	Tomorrow	TECHNOLOGICAL PROCESS FLOW FOR CYLINDER LINERS
	<p>GJL 250 <math>R_m &lt; 300</math> MPa centrifugal casting</p> <p><math>O 8 \mu\text{m}</math>, <math>A 10 \mu\text{m}</math> <math>40 - 60^\circ</math></p> <p><math>R_{pk} &lt; 0,3</math>, <math>R_k = 0,25 - 0,75</math>, <math>R_{vk} = 1,7 - 3,0</math> [<math>\mu\text{m}</math>] Measurement 2D (profilometer), SEM image (3D)</p> <p><math>&lt; 10</math> mg/1000 <math>\text{cm}^2</math>, <math>&lt; 750</math> particle/<math>\text{mm}^2</math></p> <p>Variants of the process of honing - plateau, smooth, structur, and laser honing.</p>	<p><b>MATERIAL</b></p> <ul style="list-style-type: none"> <li>Strength</li> </ul> <p><b>The casting process</b></p>	<p>GJL 300, GJV 400 <math>R_m &gt; 300</math> MPa centrifugal casting</p> <p><math>O 5 \mu\text{m}</math>, <math>A 5 \mu\text{m}</math> <math>&lt; 40 - 60^\circ &gt;</math></p> <p><math>R_{pk} = 0,2</math>, <math>R_k = 0,2 - 0,7</math>, <math>R_{vk} = 0,8 - 2,0</math> [<math>\mu\text{m}</math>] Measurements 2D (profilometer), SEM image (3D) Measurements <b>3D-WLI</b> (White Light Interferometry) - Surface topography parameters SHRV, SHRVM, SHBV [<math>\mu\text{m}^3/\text{mm}</math>], SHRS [<math>\mu\text{m}^2</math>], SHKR [<math>\mu\text{m}</math>], SHRG, SHKF, SHRQ, SHBF [%], SHPF [%] - Image of the surface topography [MBN 37800].</p> <p><math>&lt; 5</math> mg/1000 <math>\text{cm}^2</math>, <math>&lt; 500</math> particle/<math>\text{mm}^2</math></p> <p>Variants of the process of honing - smooth, structur, laser honing, - zone honing (TDC – UDC)</p>	