The Mini Traction Machine is a bench top precision traction measurement instrument. It provides fully automated traction mapping of lubricants and other fluids. The traction is generated between a upper specimen (ball or barrel) in contact against a rotating disc. The upper specimen can be either rotating or stationary.

Standard specimen configurations

The standard MTM specimens are made of AISI 52100 steel. See overleaf for further materials. Several sizes of specimens are available, giving the user access to a wide range of contact pressures. The schematics below are the specimen configurations at actual size.

Contact shapes and pressures

The most commonly used configuration, the 3/4” ball on disc, creates a point contact, allowing contact pressures up to 1.25GPa.

The 1/2” ball generates a higher contact pressure and the smaller size makes it compatible with the PCS mini-pot and with some surface analysers.

The small radius of the barrel creates a high pressure elliptical contact. This specimen has recently been used to investigate scuffing.

Contact pressures available (load range 5-75N) for each steel specimen configuration:

Hardness and surface finish

The MTM steel discs can be tailored to your needs with a choice of surface finish from rough (Ra > 0.5 µm) to mirror finish (Ra < 0.01 µm).

The discs can be heat treated to achieve various hardness, from fully annealed (185HV) to through hardened (760 HV).
Specimen material choice

MTM balls and discs have been manufactured in a wide selection of materials, in response to specific customer requirements. Below is information on some of the existing specimens. Please contact PCS to discuss alternative material composition, finish or hardness.

Selection of steels
The selection of steels has been recently broadened to include M2 tool steel. Its high tempering temperature means it can be heated up to 550°C without softening.

This property makes the M2 specimens suitable for most coating processes such as sputtering, PVD and CVD.

<table>
<thead>
<tr>
<th>Material</th>
<th>Indicative available hardness</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>AISI 52100 (EN31)</td>
<td>185 to 760 HV</td>
<td>Bearing steel, through hardened</td>
</tr>
<tr>
<td>AISI 8620</td>
<td>200 to 760 HV</td>
<td>Low alloy steel suitable for case hardening</td>
</tr>
<tr>
<td>AISI 1015 (EN32)</td>
<td>200 to 760 HV</td>
<td>Contains no chrome. Suitable for case hardening</td>
</tr>
<tr>
<td>AISI 316</td>
<td>150 HV</td>
<td>Austenitic stainless steel</td>
</tr>
<tr>
<td>AISI 440C</td>
<td>200 to 650 HV</td>
<td>Heat treatable martensitic stainless steels</td>
</tr>
<tr>
<td>AISI 420S29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tool steel M2</td>
<td>Up to 800 HV</td>
<td>Suitable for coating (DLC for example)</td>
</tr>
</tbody>
</table>

Non ferrous metals and others materials
While the surface finish influences the lubrication regime, the material components affect the surface chemistry in the contact (additives reaction). Studying specific applications is possible with the MTM as the specimens can be manufactured from a range of materials.

Using a material with different mechanical properties allows a wider range of contact pressures (up to 4.1 GPa between a steel barrel and a tungsten carbide disc).
Non ferrous metals have typically a low hardness (<200HV), whereas WC specimens are much harder (>1500 HV). This hardness enables a very fine surface finish.
For information on elastomers testing configurations, consult pcs-instruments.com.

Coatings
PCS can supply DLC (diamond like carbon) coated 52100 steel specimens [a-C:H coating, sp3 ~ 50%, H ~ 40%]. The coating process runs at a temperature low enough to not significantly soften the specimens.
For coating processes involving a temperature greater than 200°C, the specimens can be made of M2 tool steel. These specimens are sold uncoated or coated as required.
Specimens can also be supplied coated using a chemical process. For example, electroless nickel plating can deposit a layer of nickel-phosphorous alloy of various percentage of phosphorus.