CPM Rex 54 is a cobalt-bearing high speed steel designed to offer an improvement in the red hardness of the popular M4 grade, while maintaining wear properties equivalent to M4. CPM Rex 54 has a chemical analysis very similar to M4 to which cobalt has been added for superior red hardness which allows for higher cutting speeds. It contains higher vanadium (4%) than either M35 (2%) or CPM Rex 45 (3%), and therefore offers improved wear resistance over these two grades, while maintaining a similar red hardness level.

The CPM process results in a homogeneous microstructure with a finer, more uniform carbide distribution imparting superior dimensional stability, grindability and toughness when compared to steels produced by conventional processes. The CPM process also allows the design of more highly alloyed grades which cannot be produced by conventional steelmaking.

Physical Properties

- Elastic Modulus: 30 X10^6 psi, 207 GPa
- Specific Gravity: 8.14
- Density: 0.294 lbs/in^3, 8.144 g/cm^3

Coefficient of Thermal Expansion

<table>
<thead>
<tr>
<th>°F</th>
<th>°C</th>
<th>in/in/°F</th>
<th>mm/mm/°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>70-500</td>
<td>20-260</td>
<td>6.4 X 10^{-6}</td>
<td>11.5 X 10^{-6}</td>
</tr>
<tr>
<td>70-800</td>
<td>20-425</td>
<td>6.58 X 10^{-6}</td>
<td>11.8 X 10^{-6}</td>
</tr>
<tr>
<td>70-1000</td>
<td>20-540</td>
<td>6.72X10^{-6}</td>
<td>12.1 X 10^{-6}</td>
</tr>
</tbody>
</table>

Mechanical Properties

- Wear Resistance: The wear resistance of CPM Rex 54 is similar to CPM M4HC, and better than CPM Rex 45.
- Toughness: The impact toughness of CPM Rex 54 is similar to CPM M35HCHS and better than CPM Rex 45 or CPM T15.
- Red Hardness: The red hardness of CPM Rex 54 is similar to CPM T15 between CPM M35 and CPM Rex 45.

CPM Rex 54 as an Upgrade:

CPM Rex 54 provides higher attainable hardness and better heat resistance than M4. CPM Rex 54 is also an upgrade to M35 for improved wear resistance. It has a chemistry similar to M35, but with increased vanadium and carbon, for greater wear resistance. CPM Rex 54 may be substituted for M35 in nearly any application for better performance. It may also be substituted for CPM Rex 45 in most applications where higher wear resistance is desired. CPM Rex 54 offers the same cobalt level as M35, T15 and other cobalt-bearing high speed steels. (For applications requiring red hardness greater than that of CPM Rex 54, consider CPM Rex 76.)

Crucible Industries LLC
Heat Treat Response

<table>
<thead>
<tr>
<th>Temperature °F</th>
<th>HRC as-quenched</th>
<th>HRC 1000°F</th>
<th>HRC 1025°F</th>
<th>HRC 1050°F</th>
<th>HRC 1100°F</th>
<th>HRC 1150°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>2100°F</td>
<td>65.5</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>64.5</td>
<td>64.5</td>
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<tr>
<td>2125°F</td>
<td>65.5</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>65</td>
</tr>
<tr>
<td>2150°F</td>
<td>65</td>
<td>66</td>
<td>66</td>
<td>66</td>
<td>66.5</td>
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<td>65</td>
<td>65.5</td>
<td>66</td>
<td>66.5</td>
<td>67</td>
</tr>
</tbody>
</table>

Optimum for maximum toughness and effective stress relieving:
- 1025°F (550°C) - 64.5 HRC
- 1050°F (565°C) - 63.5 HRC
- 1100°F (595°C) - 61 HRC
- 1150°F (620°C) - 57 HRC

NOTE A: Results may vary with hardening method and section size. Salt or oil quenching will give maximum response. Vacuum or atmosphere cooling may result in 1-1.5 points HRC lower hardness for larger tools.

Minimum time at austenitizing temperature:
- 15 minutes
- 10 minutes
- 5 minutes

Minimum number of tempers:
- 3

Surface Treatments:
- CPM Rex 54 can be nitrided or PVD coated if desired. If a CVD treatment is used, subsequent hardening is required and may result in undesirable distortion.

Note: Properties shown throughout this data sheet are typical values. Normal variations in chemistry, size and heat treat conditions may cause deviations from these values.