STX M7 SMC

STX M7 SMC is a soft magnetic material that is characterised by high permeability and low losses at frequencies in the range from 50Hz and above. It is suitable for high operating temperature (up to 200°C) and for production of medium sized components. Typical applications are stators, rotors, coils and sensors.

Soft magnetic composites (SMC) generally have good magnetic properties such as good relative permeability and high magnetic saturation combined with high electrical resistance. In addition, they have quite unique possibilities for conducting flux in all 3 dimensions.

Production conditions

The powder is pressed in advanced tools at a typical pressure of 600 MPa. The compaction pressure depends on the geometry of the component and the magnetic properties in turn depend on the compaction pressure.

B-H curve

The B-H curve for STX M7 SMC is primarily dependent on the degree to which the powder makes up the overall volume. The saturation level increases in line with the fill percent and thereby the compaction pressure, as can be seen in figure 1.

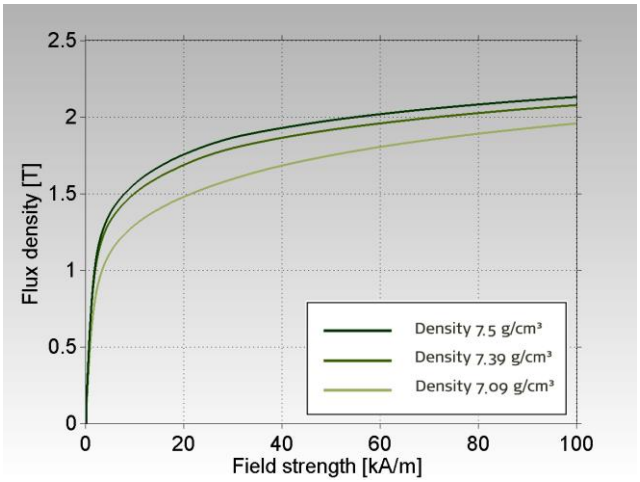

Figure 1: B-H curve for STX M7 SMC - at various mechanical densities.

Permeability

The permeability shown in figure 2 is calculated as the flux density divided by the field strength and vacuum permeability. Since the point of departure is the virgin curve, the permeability does not necessarily achieve its maximum value at 0 T. If a monotonously declining permeability is required, e.g. for finite element calculations, it is recommended that the top of the curve be cut off for values lying above the initial permeability (see dotted line).

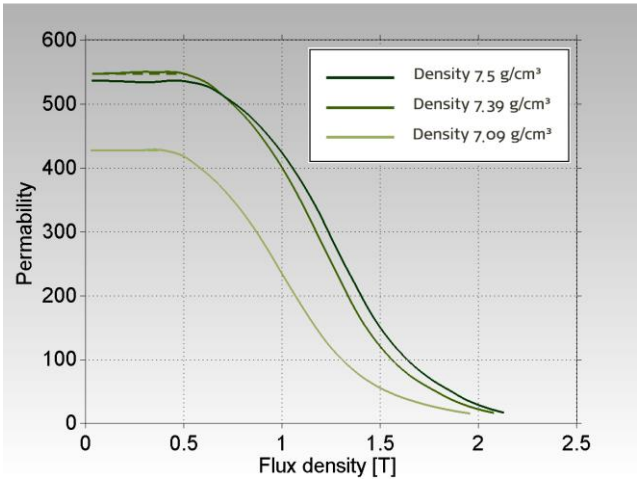

Figure 2: Permeability as a function of flux density for STX M7 SMC - at various mechanical densities.

Iron loss

Iron loss occurs as a result of the material's resistance to being magnetised (hysteresis loss) and as a result of the electrical currents which counteract the changes in the magnetic field in the material (eddy current loss).

Hysteresis loss is proportional to the frequency, whilst eddy current loss is proportional to the square of the frequency.

Figures 3 and 4 show the iron loss as a function of frequency and flux density respectively.

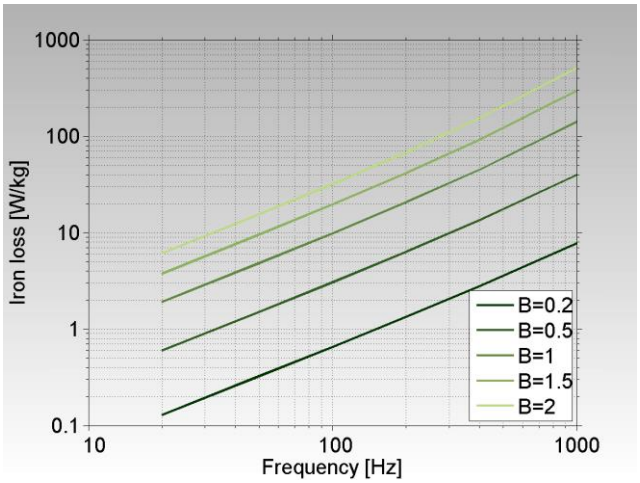

Figure 3: Iron loss as a function of frequency at different flux densities – at a mechanical density of 7.39 g/cm³.

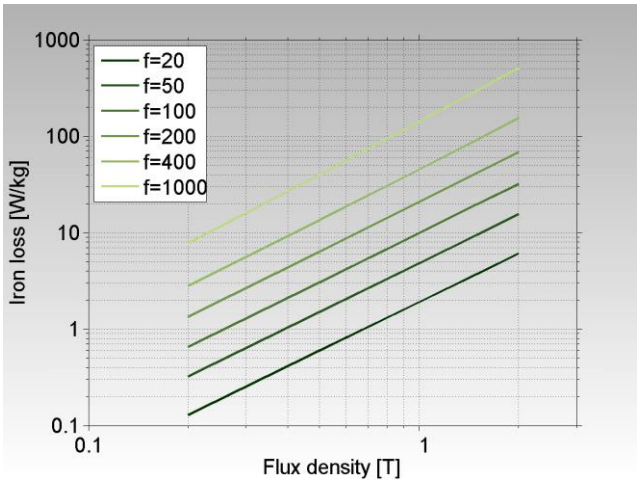

Figure 4: Iron loss as a function of flux density at different frequencies - at a mechanical density of 7.39 g/cm³.

It is important to note that eddy currents can run both locally in the individual particles (micro) and more globally in the cross section of the component (macro). Micro eddy currents normally dominate, but in the case of a large cross section, the macroscopic current can be highly significant. In such cases it is recommended to use STX B7.

Physical properties of STX M7 SMC

The SMC powder is held together by an oxide film, which is grown in a controlled process in an oven. The physical properties thereby depend primarily on the binder and the hardening process

Density [g/cm³]	7.45
3-point shear strength [MPa]	40
Tensile strength [MPa]	14
Impact energy [J]	2
E-modulus [GPa]	88

Figure 5: Mechanical and physical properties.

Density [g/cm³]	7.45
Maximum relative permeability [-]	540
Resistivity [µΩm]	400

Figure 6: Magnetic properties.

Results

The data for STX M7 SMC shown in this data sheet is based on Somaloy® 700 and has been obtained in cooperation with Höganäs AB in accordance with applicable ISO standards.

Magnetic properties were measured on toroids with dimensions of DO55 x ID45 x H5 mm.

It is not possible to directly attribute all the results to specific components, as parameters such as powder flow, component size and geometry can have an effect on the properties of the individual components.

More information

Sintex a/s is able to offer customised components in a range of different SMC materials depending on the customer's requirements in terms of frequency, physical strength and magnetic properties.

Contact us for more information about STX M7 or other types of SMC materials. You can also refer to the technical data sheets for other material types.

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