With regard to loaded conditions the machine is run as a generator with the terminals of the machine connected to a resistive load. The machine has been run over a number of load points. Due to the fact that a prototyping material has been used that has higher than normal losses the efficiency of the prototype is not considered a good indicator for pressed performance. Nevertheless the efficiency of the machine is easily over 80% at a number of operating points with a peak of 84%. There are a number of design features that can be implemented in order to improve the efficiency of the machine. The proximity of the aluminium case to the rotating field produced by the rotor is a situation not common to radial field machines and can cause parasitic losses. The use of a pressed stator component of Somaloy 5P material rather than prototyping material could alone reduce the iron loss by over 38% and the total motor losses by 29%. This can all be achieved whilst increasing the torque output by 9% due to the better material performance, the expected overall system efficiency as a result would rise to well over 85%.

Conclusions

Soft magnetic composite materials are in direct competition with traditional laminated steel materials a mature and low cost technology. Currently on a direct cost for cost basis SMCs are more expensive, however the final machine product certainly need not be. SMC machines such as the axial field machine presented in this paper provide a very simple construction perfect for high volume production by robot. There also exists the possibility to reduce the amount of more expensive components of the motor such as copper (which can be 2-3 times the cost per kg of the iron in the machine). The overall package can therefore provide a solution that is more compact, has a high performance and is also cost effective in comparison to convention machine solutions.

This paper has shown an axial field machine that can be pressed from a single SMC component. The coils of the machine can be wound directly onto bobbins and slotted onto the teeth of the machine producing a very simple design with minimal component numbers. An example machine has been tested that provides 300W, made from prototyping material the machine has a peak efficiency of 84%, however with further design optimisation and a pressed component the performance could be increased significantly.

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