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Determination of the squareness factor of magnets using the integrated area under the demagnetization curve.

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The squareness factor (SF) of a permanent magnet is commonly determined by the quotient of the knee demagnetization field (Hk) by the intrinsic coercivity (iHc) in the second quadrant curve. The knee field corresponds to the 90% of the full remanence (0.9Br) in a closed magnetic circuit after the magnet fully led at the magnetization saturation. In the present study, the integrated area under the demagnetization curve has been used the main parameter for determining the squareness factor of sintered permanent magnets. An applicative integration tool performs numerical integration on the active data plot using the trapezoidal rule. In this case, it is possible to calculate the mathematical area, i.e., the algebraic sum of trapezoids, or an absolute area, that is, the sum of absolute trapezoid values. In this work a straightforward method for determining the squareness factor has been proposed and compared with the standard ratio Hk /iHc. A standard magnet processing route with a glove box has been employed. After hydrogen decrepitation of the magnetic Nd17Fe76.5B5Cu1.5 the cast alloy has been ball milled to a fine powder using cyclohexane as the milling liquid. The fine powder was dried in vacuum at room temperature in the glove box antechamber and then handled inside the glove box. The isostatically pressed green body has been sintered at 1060oC for 1 hour employing a high vacuum (10-6 mbar) diffusion pump. Slow cooling in the furnace has been employed to optimized the sintered magnet performance. Magnetic properties were measured in a closed loop permeameter after magnet saturation by capacitive discharge in a 6 tesla pulse field. Good magnetic properties were obtained for these magnets and a comparison between the two methods of determining the SF has been successfully carried out.