Abstract. In this paper, we introduce the anisotropic Sobolev capacity with fractional order and develop some basic properties for this new object. Applications to the theory of anisotropic fractional Sobolev spaces are provided. In particular, we give geometric characterizations for a nonnegative Radon measure $\mu$ that naturally induces an embedding of the anisotropic fractional Sobolev class $\dot{A}_{\alpha,K}^{1,1}$ into the $\mu$-based-Lebesgue-space $L_{\mu}^{n/\beta}$ with $0 < \beta \leq n$. Also, we investigate the anisotropic fractional $\alpha$-perimeter. Such a geometric quantity can be used to approximate the anisotropic Sobolev capacity with fractional order. Estimation on the constant in the related Minkowski inequality, which is asymptotically optimal as $\alpha \to 0^+$, will be provided.