The charge density distribution of a functional group is predominately determined by the nuclei and bonding pattern composing the functional group and by its close environment, whereas the rest of the molecule plays a smaller role. Since many functional group properties are directly related to the charge density, they retain similar characteristics even if the rest of the molecule is different. The properties are thus indicative for this group and furthermore, they are transferable between different molecules. This is not only true for the ground state electron density but also for the polarizability and consequently for many important electrostatic and dielectric properties. Our study focuses on the polarizability of functional groups, which are obtained by partitioning of the molecular electron density into atomic contributions using the quantum theory of atoms in molecules (QTAIM) [1]. We defined a local coordinate system for each functional group and expressed the polarizability tensors with respect to this system to make them fully self-contained and thus transferable. The local coordinate system is based on the inertia tensor of the functional group; its three principal axes define the axes of the local coordinate system. Other groups [2,3] have calculated distributed polarizabilities of functional groups based on different methods. However, they have not defined any subcategories for the functional groups and thus the close environment has not been taken into account. Our goal is to group molecules containing a given functional group into clusters based on the polarizability tensor. Two different unsupervised clustering algorithms were used, k-means and an agglomerative hierarchical clustering. Generally, the algorithms are able to produce chemically meaningful clusters. The cluster means can be used as representative functional group polarizabilities for the molecules in this cluster and as building blocks to calculate the polarizability of other molecules. This allows to rapidly estimate the polarizability of large molecules and, together with the dipole moment, to approximate the crystal field and therefore the dielectric properties of a crystalline material.