Fluorescence tomographic reconstruction, based on the detection of photons coming from fluorescent emission, can be used for revealing the internal elemental composition of a sample. On the other hand, conventional X-ray transmission tomography can be used for reconstructing the spatial distribution of the absorption coefficient inside a sample. In this work, we integrate both X-ray fluorescence and X-ray transmission data modalities and formulate a nonlinear optimization-based approach for reconstruction of the elemental composition of a given object. This model provides a simultaneous reconstruction of both the quantitative spatial distribution of all elements and the absorption effect in the sample. The challenges in X-ray fluorescence tomography arising mainly from the effects of self-absorption in the sample are partially mitigated.