Martinelli *et al.* Reply: Combining synchrotron powder diffraction (SPD) [1] and muon spin rotation analysis (μSR) data [2], we drew a new phase diagram for the $SmFeAs(O_{1-x}F_x)$ system where the tetragonal-to-orthorhombic transition is retained in the superconducting phase. In the preceding Comment [3], C. R. Rotundu (CRR) objects to this result; the main criticisms are about the poor quality of the analyzed samples (fluorine content and chemical homogeneity) and the reliability of the applied analytical techniques. Moreover CRR asserts that our phase diagram would be similar to those already published without a misleading interpretation of the line broadening observed in our sample $x = 0.20$.

Our samples with $x \leq 0.05$ and $x \geq 0.10$ are representative of the fully magnetic and superconductive ground states, respectively, as revealed by μSR analysis [2]. The sample $x = 0.05$ exhibits a clear spitting of the 220 peak, but its intensity is $\sim 1/3$ that of the broadened 110 peak (Fig. 1). For this reason we investigated the thermal evolution of the 110 line, since the Bragg peak intensity is a fundamental measured quantity for line profile analysis and the precision of line parameters depends on counting statistics. Line broadenings affecting the samples $x = 0.05$ and $x = 0.10$ are very similar, indicating that symmetry breaking is retained despite the establishment of a fully superconductive ground state. In the sample $x = 0.20$ the line broadening amplitude is obviously decreased due to the progressive reduction of the orthorhombic distortion.

CRR supposes that the F content in our samples is substantially reduced, but samples prepared in different laboratories can be compared by their physical properties, rather than their nominal composition. Our sample with nominal composition $x = 0.10$ exhibits a magnetic T_c of $\sim$41 K; this value is slightly lower than that measured in the sample with nominal content $x = 0.20$ ($T_c \sim 45$ K) of Ref. [4], whose actual composition is $x \sim 0.09$. This indicates that our preparation technique [5] prevents large fluorine loss. Conversely to that asserted by CRR, detailed discussions about F distribution are reported in our Refs. [1,6]; our analysis cannot be overlooked in the Comment. Samples homogeneity was proved by an accurate microstructural analysis using the SPD data, a result supported by μSR analysis [2]. The line broadening analysis in the Comment is very shallow, not based on valid scientific argumentations and absolutely inconsistent with the theoretical analysis of the chemical fluctuations effects on line broadening [7].

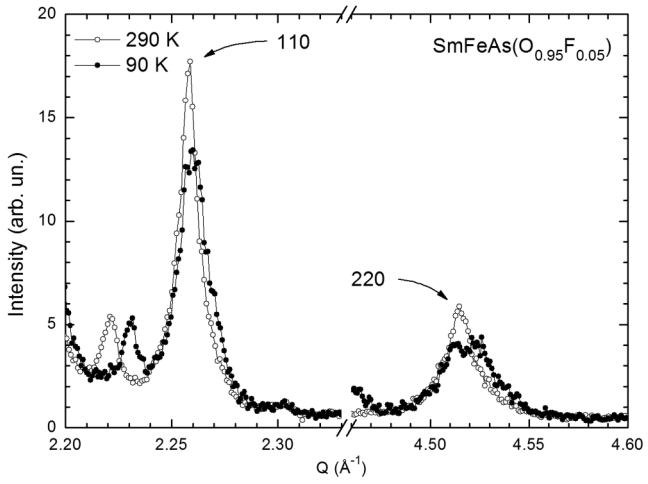

FIG. 1. Broadening and splitting of 110 and 220 peaks in $SmFeAs(O_{0.95}F_{0.05})$ (SPD data).

In general, symmetry breaking in the superconducting state has been reported in several articles; for example a $C4 \rightarrow C2$ symmetry breaking in both parent and superconducting states was previously observed by STM [8]. After the publication of our work, similar orthorhombic distortions have been reported for superconducting $BaFe_2(As_{1-x}P_x)_2$ and $Ba(Fe, Co)_2As_2$ single crystals [9,10].

Our findings were specifically confirmed by a NMR investigation on a $SmFeAs(O_{0.86}F_{0.14})$ sample with $T_c = 48$ K [11], evidencing a structural transition at 163 K in perfect agreement with our results, as well as by femtosecond quasiparticle relaxation dynamics on a superconducting electron doped single crystal of $Sm(Fe_{0.93}Co_{0.07})AsO$ [12].

In conclusion our first observation of orthorhombic distortion in the superconducting state of electron doped 1111 pnictides was confirmed by recent investigations, proving a correct interpretation of our data. We hope for more theoretical and experimental studies on this topic that could give useful insights for a better understanding of the physics of these systems.

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