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Neutron diffraction study on magnetostructurally coupled triangular lattice antiferromagnet Ba3TbRu2O9

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Ba3MA2O9 compounds have gained significant attention due to various exotic magnetic ground states depending upon the various combinations of M and A atoms. For instance: Ba3NiSb2O9, Ba3CuSb2O9, and Ba3IrTi2O9 exhibit quantum spin-liquid behavior [1-3], while Ba3ZnIr2O9 [4] shows a quantum spin-orbital liquid state. However, the magnetic ground of these compounds with M = rare-earth and A = 4d transition-metals is not explored too much. In this work, we show the magnetization and neutron diffraction results on Ba3TbRu2O9. Rietveld refinement of the neutron diffraction data infers the Tb magnetic order at ~9.8 K (TN) where ferromagnetic Tb moment planes are coupled antiferromagnetically along the c-direction. An antiferromagnetic Ru dimer ordering is also evident below TN from the Rietveld refinement of the neutron diffraction data. Further, the Rietveld refined Tb moment is fitted with the power law, and the derived critical exponent parameter indicates the 3D Ising interactions in the systems. Interestingly, the structural parameters like lattice constant, unit-cell-volume, and bond lengths show an anomaly at TN, indicating a magnetostructural coupling in the compound. The present study underscores the importance of the title compound in spintronic devices.

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