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Colossal proximity effect in a superconducting triplet spin valve based on the half-metallic ferromagnet CrO2 AMRITA SINGH, STEFANO VOLTAN, KAVEH LAHABI, JAN AARTS, Kamerlingh Onnes Laboratory — Combining superconductors (S) and ferromagnets (F) offers the opportunity to create a new class of superconducting spintronic devices. In particular, the S/F interface can be specifically engineered to convert singlet Cooper pairs to spin-polarized triplet Cooper pairs. The efficiency of this process can be studied using a so called triplet spin valve (TSV), which is composed of two F-layers and an S-layer. When the magnetization in the two F-layers are not collinear, singlet pairs are drained from the S-layer, and injected as triplet generation is therefore signalled by a decrease of the critical temperature T_c. Here, we build highly efficient TSVs using a 100% spin polarized half-metallic ferromagnet, CrO_2. The application of large out of plane magnetic fields results in an extremely strong suppression of T_c, by almost a Kelvin. The observed effect is nearly an order of magnitude larger than previous studies on TSVs with standard ferromagnets. Furthermore, we clearly demonstrate that this triplet proximity effect is strongly dependent on the transparency and spin activity of the interface. Our results are particularly important in view of the growing interest in generating long range triplet supercurrents for dissipationless spintronics.

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