Production of ^{40}Mg Following 2p Knockout from ^{42}Si

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The experimentally observed collapse of the N=28 shell closure in $^{42}_{14}$Si has suggested a large oblate deformation at Z=14 and N=28. The isotonic nucleus ^{40}Mg may be expected to have mid-shell character, and a similarly large deformation. Combined with the fact that it may lie at the edge of the neutron drip-line for Z=12, ^{40}Mg is a key nucleus for understanding single-particle and shape evolution in the sd-fp shell, as well as the possible effects of weak binding, and benchmarking theories describing the most exotic nuclei.

The inclusive two-proton knockout reaction cross-section for ^{42}Si into ^{40}Mg has been measured in an experiment performed at the RIBF, at RIKEN Nishina Center. A secondary ion beam of ^{42}Si was produced following fragmentation, and identified through the BigRIPS fragment separator. Following reactions on a thick ^{12}C target, five ^{40}Mg were uniquely identified in the ZeroDegree spectrometer, and the inclusive two-proton knockout cross-section into ^{40}Mg was measured for the first time. Comparison with shell-model calculations suggests that the cross-section is consistent with a drastic change in nuclear shape between the ^{42}Si and the ^{40}Mg ground states. We report on the cross-section results, and implications for understanding shape evolution along the N=28 isotonic chain.