Pairing transition at Finite Temperature in ^{184}W

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We extract pairing gap in ^{184}W at finite temperature for the first time from the experimental level densities of ^{183}W, ^{184}W, and ^{185}W using "thermal" odd-even mass difference. We found the quenching of pairing gap near the critical temperature $T_c = 0.47$ MeV in the BCS calculations. It is shown that the monopole pairing model with a deformed Woods-Saxon potential explains the reduction of the pairing correlation using the partition function with the number parity projection in the static path approximation plus random-phase approximation.

In recent theoretical approaches, the quenching of pairing correlations have been obtained within the SPA+RPA, the shell model Monte Calro calculations, the finite-temperature Hartree-Fock Bogoliubov theory, and the relativistic mean-field theory. Their calculations show that the pairing correlation (gap) does not become quickly zero at a certain critical temperature in the BCS theory. It has recently been reported [1] that the canonical heat capacities extracted from the observed level densities in ^{162}Dy, ^{166}Er and ^{172}Yb form the S shape with a peak around the temperature $T \approx 0.5$ MeV. This S shape was considered as a signature of the nucleon Cooper pair breaking because this temperature is close to the critical temperature $T_c = 0.57\Delta \approx 0.5$ MeV in the BCS theory. However, the pairing gap has not been obtained from the experimental data so far.

Our main purpose is to extract the pairing gap of ^{184}W at finite temperature from the experimental level densities of ^{183}W, ^{184}W, and ^{185}W recently observed [2]. To obtain the pairing gap, we introduce "thermal" odd-even mass difference [3], which is the extension of odd-even mass difference. We suggest that the pairing correlations can be estimated from the measured level densities of the triplet nuclei with neutron number $N+1, N$, and $N-1$.

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