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On the sum of strictly k-zero matrices

Let k be an integer such that $k \geq 2$. An n-by-n matrix A is said to be strictly k-zero if $A^k = 0$ and $A^m \neq 0$ for all positive integers m with $m < k$. Suppose A is an n-by-n matrix over a field with at least three elements. We show that if A is a nonscalar matrix with zero trace, then i) A is a sum of four strictly k-zero matrices for all $k \in \{2, \ldots, n\}$; and ii) A is a sum of three strictly k-zero matrices for some $k \in \{2, \ldots, n\}$. We prove that if A is a scalar matrix with zero trace, then A is a sum of five strictly k-zero matrices for all $k \in \{2, \ldots, n\}$. We also determine the least positive integer m such that every square complex matrix A with zero trace is a sum of m strictly k-zero matrices for all $k \in \{2, \ldots, n\}$.