Non-existence of difference sets with order $n = m^2$, where $m$ is a natural number greater than 1.

The existence of Hadamard $(4t - 1, 2t - 1, t - 1)$ difference sets in cyclic group provides a platform for solving the equation $\delta \bar{\delta} = n$ in the cyclotomic ring $\mathbb{Z}[\zeta_{4t-1}]$, where $\zeta_{4t-1}$ is root of unity, $n > 1$ and $t > 1$ are integers. We look at cases where $\langle n \rangle = \langle \delta \rangle \langle \bar{\delta} \rangle$ in $\mathbb{Z}[\zeta_{4t-1}]$ but $\delta \bar{\delta} = n$ has trivial solutions. This criterion is combined with other results to conclude non-existence of some difference sets. (Received July 23, 2012)