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A building-up construction is a way to construct all self-dual codes from smaller length self-dual codes. It depends on the size of the ground alphabet. In this paper, we complete the building-up construction for self-dual codes over  $GF(q)$  with  $q \equiv 3 \pmod{4}$ , and over  $\mathbb{Z}_{p^m}$  and Galois rings  $GR(p^m, r)$  with an odd prime  $p$  satisfying  $p \equiv 3 \pmod{4}$ . We also present a building-up construction for self-dual codes over finite chain rings and  $p$ -adic rings  $\mathbb{Z}_{p^\infty}$  with any odd prime  $p$ . As examples, we reconstruct more than 600 extremal self-dual ternary  $[28, 14, 9]$  codes, improving 32 previously known codes. We also construct many self-dual codes over  $\mathbb{Z}_9$  of lengths 12, 16, 20 all with minimum Hamming weight 6, which is the best possible minimum Hamming weight among free self-dual codes over  $\mathbb{Z}_9$  of these lengths. (Received July 23, 2008)