On the Koszul property of toric face rings

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Toric face rings is a generalization of the concepts of affine monoid rings and Stanley-Reisner rings. We consider several properties which imply Koszulness for toric face rings over a field k. Generalizing works of Laudal, Sletsj\o{}e and Herzog et al., graded Betti numbers of k over the toric face rings are computed, and a characterization of Koszul toric face rings is provided. We investigate a conjecture suggested by R\"{o}mer about the sufficient condition for the Koszul property. The conjecture is inspired by Fr\"{o}berg's theorem on the Koszulness of quadratic squarefree monomial ideals. Finally, it is proved that initially Koszul toric face rings are affine monoid rings.

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