

## Synthesis, Structure and Photocatalysis in $\text{LiBi}_4\text{Ta}_3\text{O}_{14}$ and $\text{LiBi}_4\text{Nb}_3\text{O}_{14}$

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The application of photocatalytic materials in wastewater treatment, control of toxic air contaminants and remediation of hazardous wastes has been of interest. Several materials like  $\text{TiO}_2$ , pyrochlores and bismuth tantalates have been extensively studied. In search of novel structural types with enhanced photo-catalytic activities, a series of new compounds,  $\text{LiBi}_4\text{Ta}_3\text{O}_{14}$  and  $\text{LiBi}_4\text{Nb}_3\text{O}_{14}$  in the  $\text{Li}_2\text{O}-\text{Bi}_2\text{O}_3-(\text{Nb}/\text{Ta})_2\text{O}_5$  system have been isolated for the first time in the hitherto unknown lithium bismuth niobates and tantalates. Both the compounds crystallize in the monoclinic space group,  $C2/c$  with  $a = 13.115(2) \text{ \AA}$ ,  $b = 7.583(1) \text{ \AA}$ ,  $c = 12.226(2) \text{ \AA}$ ,  $\beta = 101.477(3)^\circ$ ,  $V = 1182.6(5) \text{ \AA}^3$  and  $Z = 4$ ;  $a = 13.035(3) \text{ \AA}$ ,  $b = 7.647(2) \text{ \AA}$ ,  $c = 12.217(3) \text{ \AA}$ ,  $\beta = 101.512(4)^\circ$ ,  $V = 1193.4(5) \text{ \AA}^3$  and  $Z = 4$  for  $\text{LiBi}_4\text{Ta}_3\text{O}_{14}$  and  $\text{LiBi}_4\text{Nb}_3\text{O}_{14}$  respectively. The structures were solved by direct methods and refined to  $R$  of 0.057 and 0.078. The crystal structure consists of layers of  $[\text{Bi}_2\text{O}_2]^{2+}$  units separated by layers of  $\text{LiO}_4$  tetrahedra and  $(\text{Nb}/\text{Ta})\text{O}_6$  octahedra hence depicting a new structural type.

The UV-Visible diffuse reflectance spectra suggest a band gap of 3.4eV and 3.2eV for  $\text{LiBi}_4\text{Ta}_3\text{O}_{14}$  and  $\text{LiBi}_4\text{Nb}_3\text{O}_{14}$  respectively. Photo-catalytic degradation of a wide range of dyes was studied.

**Keywords:** crystal structures, photocatalysis, dyes