

Catalytic Activity and Selectivity of Evacuated Calcium Oxide for Isomerization of But-1-ene

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Summary Calcium oxide treated in air, does not catalyse the isomerization of but-1-ene even at 200°, but calcium oxide treated *in vacuo* catalyses the isomerization at 30°, selectively forming *cis*-but-2-ene.

BUT-1-ENE is known to isomerize to but-2-ene over base catalysts such as potassium *t*-butoxide¹ and alumina.² Since calcium oxide is a solid base,³ we have studied its catalytic activity for the isomerization.

Isomerizations were carried out in a closed circulation apparatus (470 ml) with an initial pressure of 200 mmHg of but-1-ene over 17–140 mg of catalyst at 30–200°. 63% but-1-ene isomerized to *cis*- and *trans*-but-2-ene at 30° in 20 min when only 17 mg of calcium oxide prepared by calcining its hydroxide *in vacuo* for 1 h at 600° was used. No other products were found. The activity of the catalyst was about one hundred times higher than that of silica-alumina. However, no reaction occurred even at 200° in 120 min with 140 mg of calcium oxide prepared by calcining the hydroxide in air for 3 h at 350–900°.³

The catalytic activity k obtained from $-dp/dt = k[1 - \alpha(p_0 - p)]$, where p is partial pressure of but-1-ene, p_0 the initial pressure, and α constant, increases sharply with rise of evacuation temperature above 350°, attains a maximum at 600°, and then decreases at higher temperatures (Figure). The ratio of *cis* : *trans*-but-2-ene at zero

conversion, obtained by extrapolation, is highest (ca. 7) at an evacuation temperature of 400° and decreases to less than 1 above 600°.

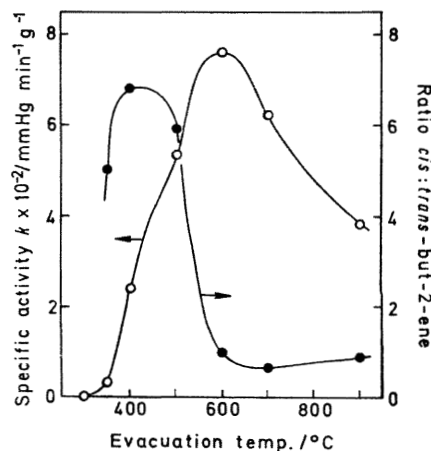


FIGURE Catalytic activity and selectivity of calcium oxide versus calcination temperature in vacuo, at 30°.

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¹ S. Bank, A. Schriesheim, and C. A. Rowe, jun., *J. Amer. Chem. Soc.*, 1965, **87**, 3244; S. Bank, *ibid.*, p. 3245.

² H. Pines and J. Manassen, *Adv. Catalysis*, 1966, **16**, 49.

³ K. Tanabe, 'Solid Acids and Bases,' Kodansha, Tokyo and Academic Press, New York & London, 1970, p. 38.