INTRODUCTION

As mentioned earlier [1], the main effect of the promoter in the hydrogenation of propanal over platinum seems to be the creation of sites where propanal can be adsorbed in a more reactive form, probably bound only via the oxygen atom (the $\eta_1$(O) adsorption mode) to the surface. Also, it appears that on this new adsorption site propanal is adsorbed more weakly to the surface than in the less reactive adsorption mode, which is the prevailing propanal adsorption mode on unpromoted catalysts. For the hydrogenation of acetone over platinum two effects of promotion are observed. The most important effect is the decrease in deactivation of the catalyst. However, after addition of a promoter a small increase in activity of the catalyst at low conversion is found, too.
It seems interesting to establish whether the promoter stabilizes the adsorption of the carbonyl group in the reactive adsorption mode also on palladium. Competition catalytic experiments, as applied in [1] are a suitable tool to achieve this goal. Palladium is a particularly convenient catalyst to study this effect, since it is a weak catalyst in the hydrogenation of carbonyl group [2]. Indications exist that this is due to specific adsorption through the carbonyl group [3]. In this study, the effect of the addition of the Ga-promoter has been tested by measuring the activity of the promoted and unpromoted palladium catalyst in the hydrogenation of acetone and of propanal, with single feed experiments and competitive hydrogenation experiments.

EXPERIMENTAL

Catalyst preparation

Catalysts were prepared as described in [1], by wet impregnation of PdCl₂ (Johnson Matthey). Unpromoted catalyst used is 1.0 wt.% Pd/Aerosil. The Ga-promoted catalyst, PdGa is made by post impregnation of 1.0 wt.% Pd/Aerosil with GaCl₃ (Merck) and has a Ga/Pd molar ratio of 0.50. The catalysts were first activated *ex situ* by reduction in pure hydrogen, at 573 K for 3 h. Before catalytic testing, all catalysts were re-reduced *in situ* for 1 h at 573 K.

Catalyst characterization

Information on the metal dispersion and promoter coverage has been obtained by transmission electron microscopy and by CO-chemisorption (at 273 K) from the hydrogen flow.

Catalyst testing

Catalysts were tested in a standard flow system. Gases were analyzed by a Gas Chromatograph with FID as detector.

For an experiment, 50-100 mg catalyst was used and reaction was performed at 373 K at 1.1 bar hydrogen pressure. The pressures of acetone, propanal and 1-propanol were between 0.019 and 0.040 bar. Total flow was 20 -30 mL/min for the reactions of acetone and propanol with single feed and 20 mL/min for the competition experiments. The reaction conditions of the single feed experiments with propanal were: \( P(\text{propanal}) = 27 \text{ mbar} \); 50 mg catalyst used per experiment; flow 30 mL/min, and for the single feed experiments with acetone: \( P(\text{acetone}) = 35 \text{ mbar} \); 50 mg catalyst used per experiment; flow 20 mL/min. Competition