**THE USE OF FLY ASH FOR THE PRODUCTION OF NICKEL-BASED CATALYST**

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## INTRODUCTION

The necessity to reduce carbon dioxide emission causes that more and more researchers' attention is directed to chemical methods of carbon dioxide utilization. Selected nickel-based catalysts [1] are used in selected processes, embedded in various supports [2]. The catalyst support should fulfill the following tasks: increasing the surface area of the active phase and increasing the catalyst strength. In the presented studies, a zeolite synthesized from fly ash was proposed as a catalyst carrier.

## EXPERIMENTS

The catalyst support proposed was zeolite from fly ash. This material was obtained by fusion synthesis method [3]. The starting material for the synthesis was fly ash from the Polish heat and power plant. The obtained material was examined using the XRD technique.

## IMPREGNATION-DEPOSITION OF THE ACTIVE PHASE

10% (10% Ni Zeolite X) and 15% (15% Ni Zeolite X) nickel% wt. (from Ni $(NO_3)_2$ solution * $6H_2O$) were applied to the support. In order to introduce the active phase, the wet incipient impregnation procedure was applied. After the impregnation process, the samples were dried and subjected to a calcination process.

## PRELIMINARY CATALYST ANALYSIS

After the calcination process, the XRD test was carried out (Chart 1a). It was aimed at determining whether nickel oxide crystals are present in the catalyst structure.

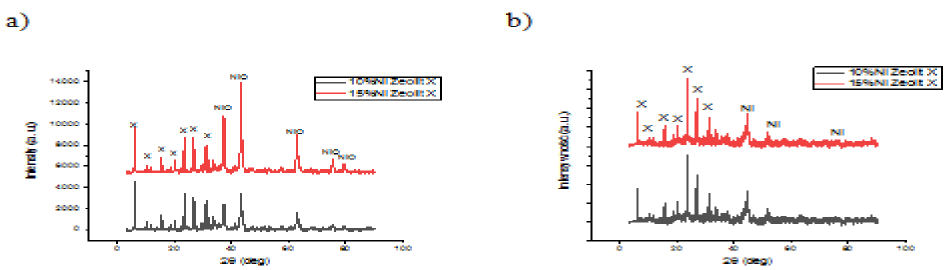


Chart 1:Diffractograms of catalysts a) after the calcination process, b) after reduction

The next catalyst investigation step was the TPR analysis of both the pure catalyst support and the impregnated samples. The results of the analysis of all samples are presented in Chart 2.

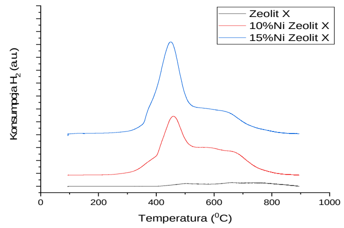


Chart 2: Results of TPR analysis

Impregnated samples after TPR testing were again tested using XRD (Chart 2.b). The material surface area measurementallowed to determine that for the 10% Ni impregnated material, the specific surface area was 191$m^2$/g and for the 15% Ni impregnated sample $S_{BET}$ was 190 $m^2$/g.

## RESULTS ANDDISCUSSION

As a result of the synthesis process zeolite was obtained from fly ash, its presence was confirmed by XRD. The impregnation and calcination process led to the appearance of NiO crystals. Due to the necessity of obtaining nickel at zero oxidation level, material reduction in a hydrogen atmosphere was carried out. The obtained TPD curves allow to observe that during the reduction of impregnated zeolite, hydrogen consumption increases. The curve for zeolite X allows to state that in the non-impregnated material there is also a process of reduction. After the reduction process, the diffraction patterns of impregnated samples clearly show that nickel oxides have undergone a reduction process. The value of the specific surface compared to the starting material has been reduced.

## CONCLUSION

Research confirms that synthesis of zeolite from fly ash is possible. This material can be used as a catalyst carrier. The introduction of nickel in the impregnation process was successful, as evidenced by $S_{BET}$, XRD and TPD tests. The obtained material is perspective as a catalyst for selected processes of chemical utilization of carbon dioxide.

## REFERENCES

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