KINETIC MODELING OF CATALYST DEACTIVATION FOR LIGHT GAS CATALYTIC CRACKING IN THE PRESENCE OF STEAM

Bijan Barghi[1] (presenting author), Allan Niidu[1]

[1]*Chemical and Material Technology Department, Virumaa College, Tallinn University of Technology, Järveküla tee 75, Kohtla-Järve, Estonia*
e-mail of presenting author: bibarg@taltech.ee

A kinetic study of catalyst deactivation used for a light gas catalytic cracking. For this purpose, analysis of different coke types and modeling the formation are taken into account for a modified ZSM-5. Also, a sintering and dealumination model proposed to improve the deactivation kinetic equations. The presence of small amounts of steam can reduce coke formation and enhance catalyst activity. In this model both advantage during gasification and disadvantage during sintering is studied simultaneously. However, it is easier to model deactivation against time, the presented model is more flexible and efficient since it could model special situations, such as when the catalyst is partially regenerated.

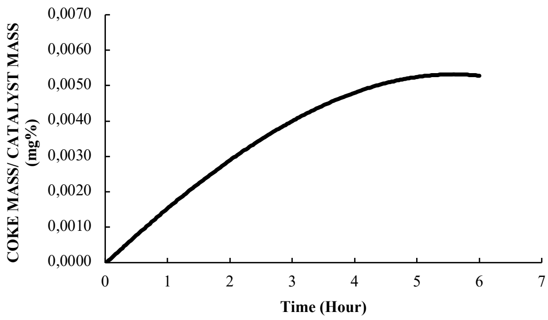

Figure 1. Coke formation rate on ZSM-5 catalyst in the presence of steam

Table 1. Optimized kinetic parameters including activation energy and pre-exponential for proposed model of deactivation

Item	Value	Unit	Item	Value	Unit	R^2
k_{0s1}	9.88	$min.mlit^{-1}$	E_{s1}	5.36×10	kJ mol^{-1}	0.98
k_{0s2}	5.14×10^{-5}	$min.mlit^{-2}$	E_{s2}	~ 0	kJ mol^{-1}	0.97
k_{0G1}	1.06×10^5	$(mg\ coke)^{2/3}\cdot(mg\ cat)^{-2/3}\cdot min^{-1/2}$	E_{G1}	7.28×10	kJ mol^{-1}	0.99
k_{0G2}	7.04×10^{13}	–	E_{G2}	1.13×10^2	kJ mol^{-1}	0.96
k_{0d1}	0.26	min^{-1}	E_{d1}	2.08×10	kJ mol^{-1}	0.98
k_{0d2}	2.80×10^{-2}	min^{-1}	E_{d2}	2.88×10	kJ mol^{-1}	0.97
k_{0cat}	3.46×10^{21}	$min^{-0.5}$	E_{cat}	4.25×10^2	kJ mol^{-1}	0.83
k_{0cont}	4.68×10^{-2}	–	E_{cont}	1.094×10^2	kJ mol^{-1}	0.96
k_{0al}	6.70×10^3	bar^{-1}	E_{al}	1.093×10^2	kJ mol^{-1}	0.96
α	1.12	$(mg\ coke)^{-n}\cdot(mg\ cat)^{n}$				
n	0.39	–				

Euroopa Liit
Euroopa
Regionaalarengu Fond

Eesti
tuleviku heaks