

**Effect of Mechanical Pre-  
activation of a Reaction Mixture  
on Nitriding of  
Ferrochromaluminium in the  
Combustion Mode**

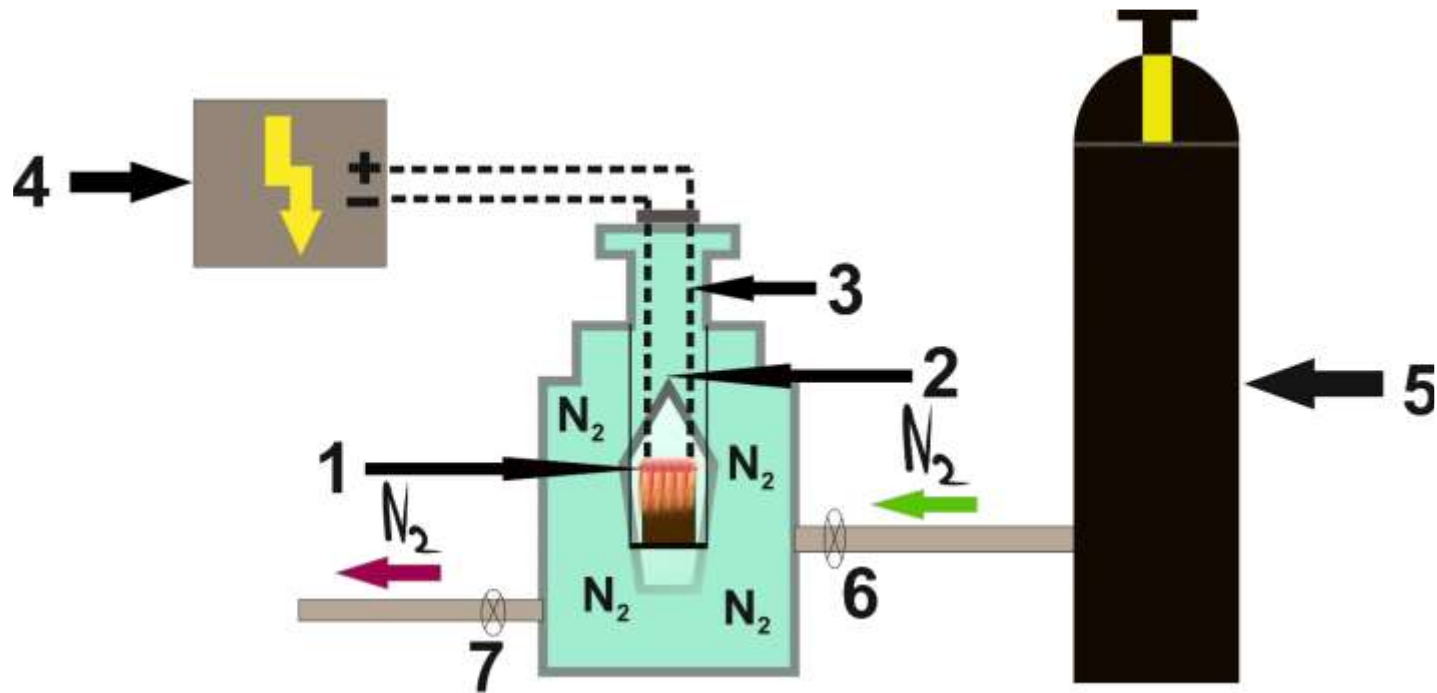
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# Ferrochromaluminium (FCA)

<b>Phase composition</b>	$\text{AlFe, Cr, AlFeCr}_2$		
<b>Chemical composition</b>	<b>Fe</b>	<b>Cr</b>	<b>Al</b>
	<b>32.6 %</b>	<b>61.0 %</b>	<b>6.4 %</b>



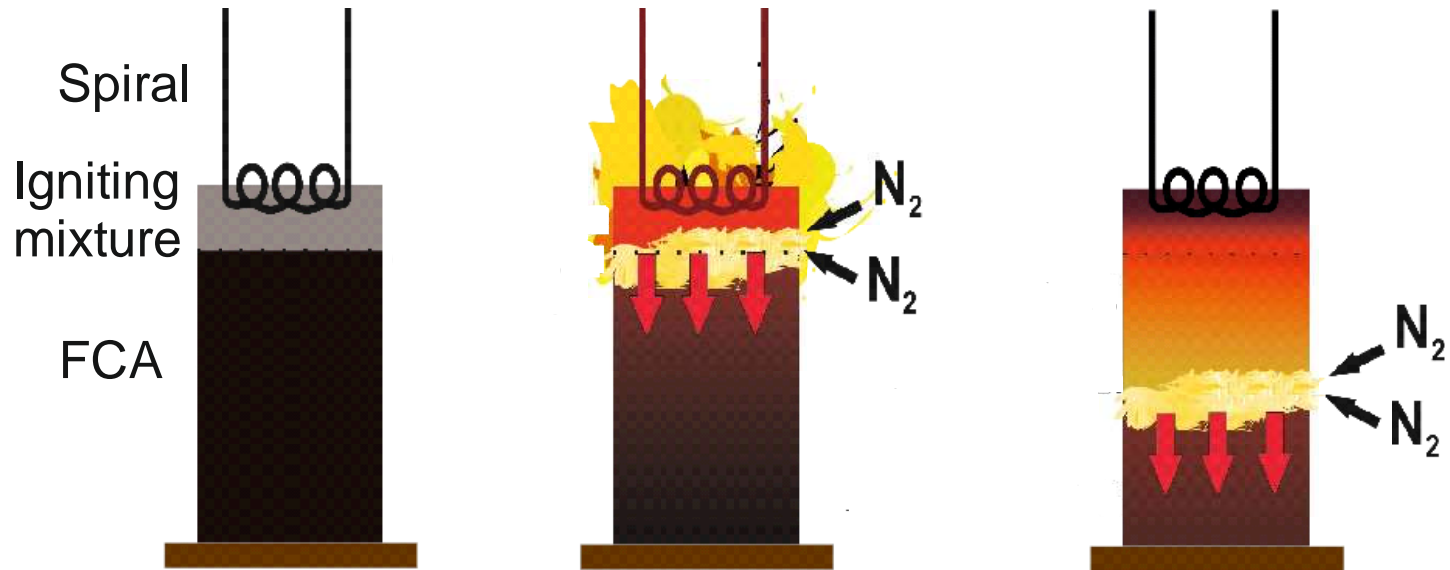
# Installation diagram

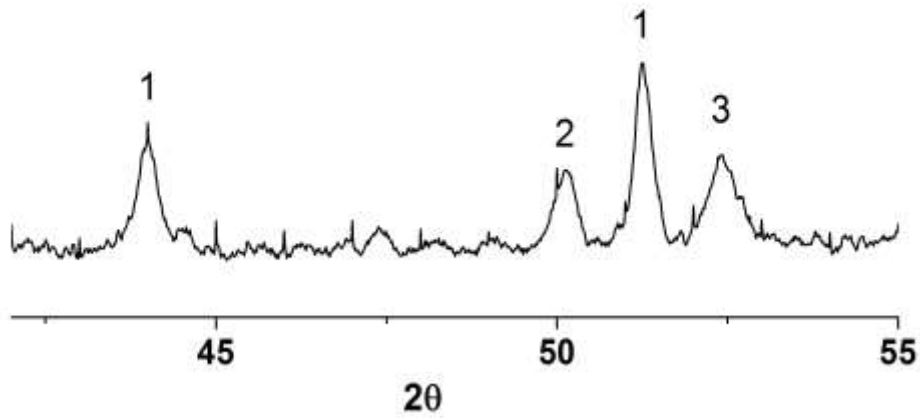


1. FCA
2. Window
3. Spiral
4. Booster

5. Nitrogen
6. Nitrogen supply
7. Nitrogen discharge

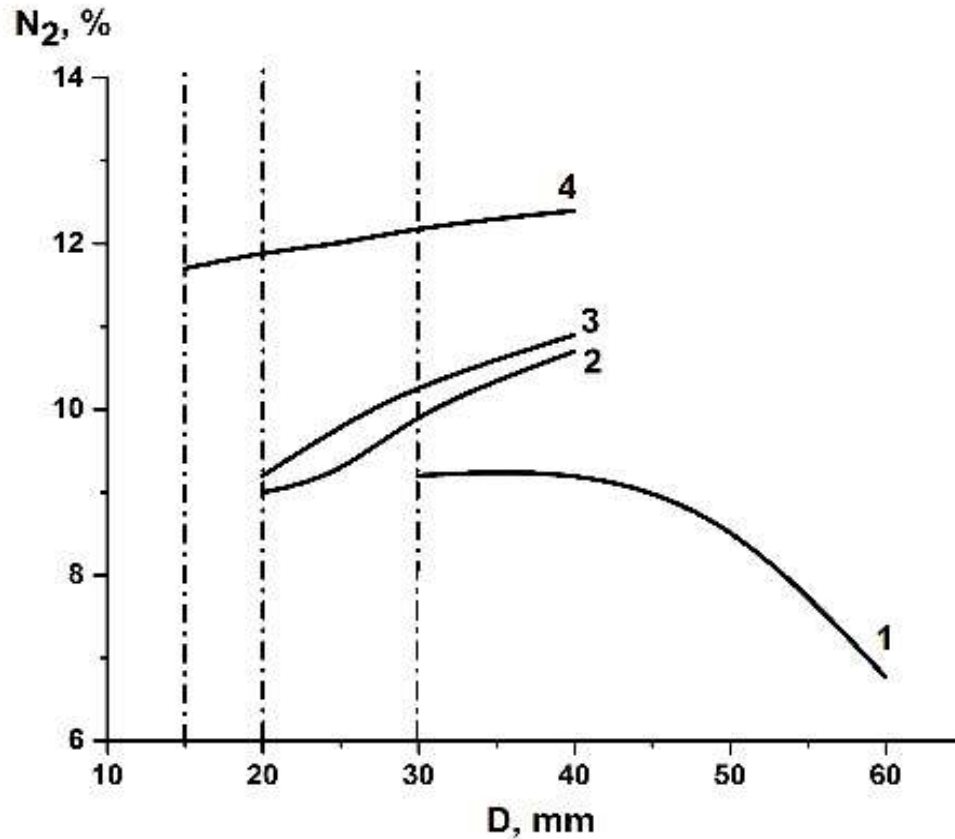
# Synthetic methodology



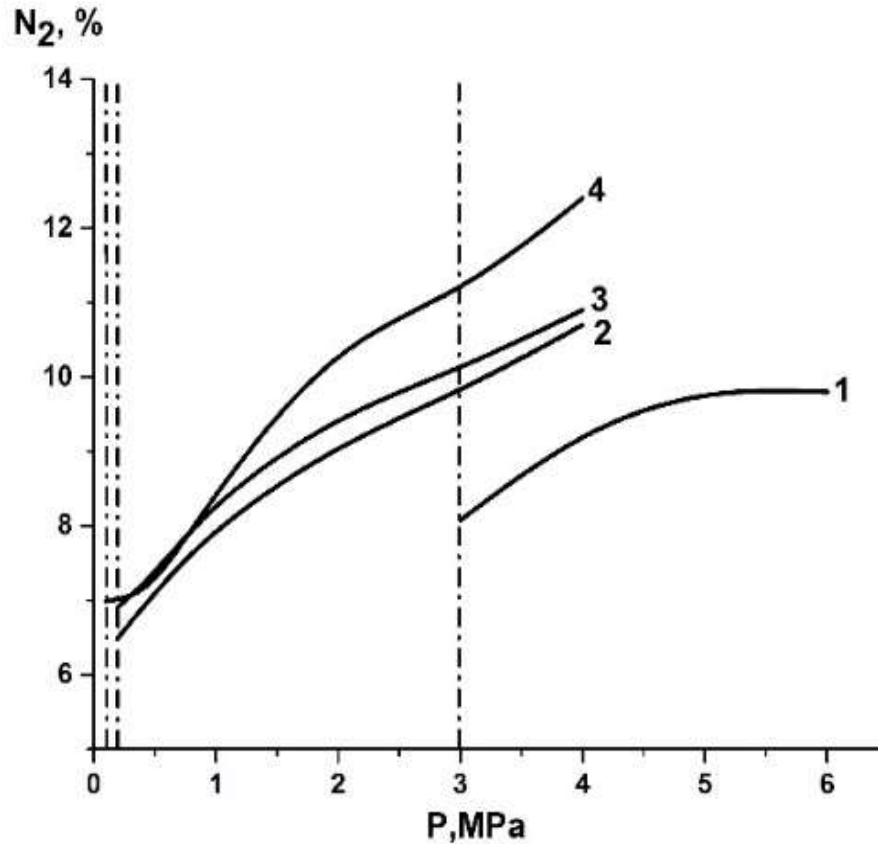


X-Ray FCA (D=40 mm, P=4MPa,  $\delta < 100\mu\text{m}$ )  
(1 – CrN, 2 –  $(\text{Cr,Fe})_2\text{N}_{1-x}$ , 3 –  $\alpha\text{-Fe}$ )

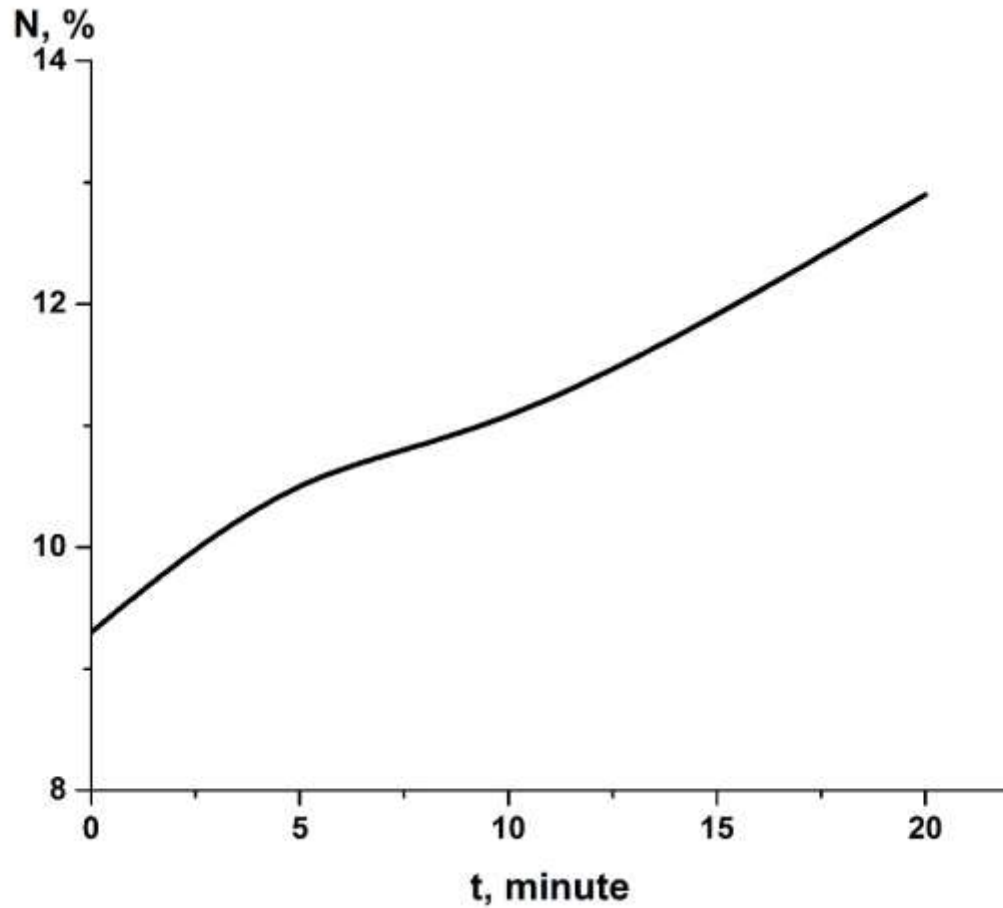




Amount of absorbed nitrogen ( $N_2$ ) as a function of the diameter of the FCA samples ( $D$ ) at a pressure ( $P$ ) of 4 MPa ((1) unactivated FCA, (2) 5 min activation of FCA, (3) 10 min activation of FCA, (4) 20 min activation of FCA).

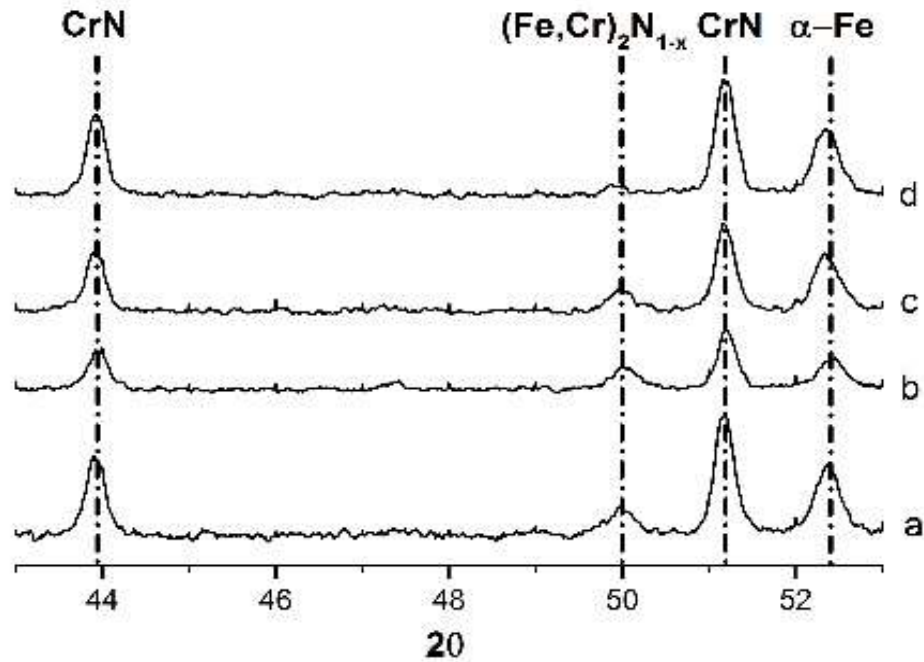


Amount of absorbed nitrogen ( $N_2$ ) as a function of the nitrogen pressure ( $P$ ) with a diameter ( $D$ ) of 40 mm ((1) unactivated FCA, (2) 5 min activation of FCA, (3) 10 min activation of FCA, (4) 20 min activation of FCA).



Amount of absorbed nitrogen ( $N_2$ ) as a function of the activation time of FCA powder ( $t$ ) at a pressure ( $P$ ) of 4 MPa and a diameter ( $D$ ) of 40 mm.





X-ray diffraction patterns of nitrated FCA ((a) unactivated FCA, (b) FCA activated for 5 minutes, (c) FCA activated for 10 minutes, (d) FCA activated for 20 minutes).

# Conclusions:

- 1) It was stated that mechanical pre-activation contributed to the expansion of combustion limits for FCA powder – diameter no less than 15 mm and nitrogen pressure no less than 0.2 MPa.
- 2) It was revealed that mechanical activation of the initial FCA mixture increased the amount of absorbed nitrogen from 8% to 13%.
- 3) It was established that the combustion products of FCA powders subjected to mechanical pre-activation contain CrN,  $\alpha$ -Fe и  $(\text{Fe,Cr})_2\text{N}_{1-x}$  phases. With an increase in the activation time, the completeness of the chemical reaction increases, which leads to the disappearance of intermediate reaction products  $((\text{Fe,Cr})_2\text{N}_{1-x})$ .

**THANK YOU FOR YOUR  
ATTENTION!**