UNIVERSAL PLASMA-CHEMICAL MODULE FOR CARBON-CONTAINING RAW MATERIALS TREATMENT

Hyun-Seo Park, Hwan-No Lee, Soon-Sang Kwon, Hak-I Kim, *I. M. Zasypkin
Jeonju University, *Request researcher

1. INTRODUCTION: PLASMA-CHEMICAL REACTORS

Wide-spread using of the plasma torches in chemical and metallurgical industries, for testing of heat shielding coatings of space apparatus, in aerodynamical and other researches advanced some problems such a design of high power electric arc reactors with long life-time, uniform in cross-section temperature and velocity fields, high heat and electrical efficiencies[1].

With widening of electric arc gas heater application field the trend of increasing of technological installation power is observed. The power of one plasma torch unit exceed for a long time tens MW.[2] But life-time of this arc heaters is very small, because high arc currents are used. Using of mixing chamber with a few plasma torches give us possibility to solve the problem of design of plasma-chemical reactors with needed power, uniform temperature, pressure, velocity fields and long life-time.

High importance at the sate time with choice of optimal technological parameters of reactor have engineering problem of its design. This reactor is obliged to provide:

- feeding of raw materials in the most heated region of gas stream for maximal their treatment;
- high stability of working parameters in reaction zone;
- exclusion (if it needs) oxidizing of reaction products in the case of installation decompression and any others.

This problems and natural aspiration to keep compactness of plasma equipment stipulated for development of number of plasma reactor design. Review of Russian developments in this area is given in monography[3]. There are three main schemes of reaction chamber :

a) reactor with parallel jets. In this reactor a few plasma torches are disposed in one plane what ensured effective treatment of polydispersive raw materials;
b) reactor with fluidized bed. In this reactor raw materials arrived in high-temperature area of plasma jet from surrounding fluidized bed zone;
c) reactor with alignmentally attached plasma torch including anti-parallel raw feeding.

Some more scheme is the multi-arc reactor, in which several plasma jets are injecting in the raw material stream, what give us the possibility to design plasma apparatus with high power.

Thus, the reactors for plasma-stream treatment of raw materials may be used in technological circuits of industrial production and they are now ordinary in chemical technologies. But the main question of the applied plasma-chemistry doesn't solve; there

is the development of scientifical basis of plasma-chemical reactor design. As a rule the choice of the reactor scheme and its design are carried out by empirical way[1].

This conclusion may be confirmed by some known elaborations, connected with municipal and industrial waste treatment[4,5]. Some variants of plasma-chemical installations suggested in these articles based on the experience of furnace burning or treatment of waste or raw materials. One-times for the part of this works more effective may be the using of plasma-chemical reactor treatment. The example of large-scale using of universal plasma-chemical unit for treatment of natural gas and coal adduced in this article.

2. CONCLUSIONS

1. Universal plasma-chemical module for industrial realization of the processes of plasma-chemical pyrolysis of carbon-containing raw materials is developed by Russian specialists.

2. Laboratory and pilot-plant studies of the processes of acetylene production natural gas and some types of coal carried out. High effectivity of this method of raw materials treatment as compared with traditional mode of production demonstrated.

3. Pilot-plant tests carried out in composition of industrial installations of organic production synthesis by using of universal plasma-chemical module.

4. There was developed and realized in industry the schemes of insertions of plasma-chemical units in manufacturing cycle.

REFERENCES

1. Electric arc generators of thermal plasma // M.F.Zhukov, I.M.Zasypkin, A.N.Timoshevskij et al. - Novosibirsk: Science. Sib. enterprise of RAS. - 1999. (Low-temperature plasma. Vol.17)(in Russian).
2. Painter J.H., Crowtil J.K.//AIAA Journal, 1980. -Vol.18, No.3
3. Krapivina S.A. Plasma-chemical technological processes.- Leningrad : Chemistry. 1981. (Russian).
4. R.L. Gillins and S.D. Poling. Plasma Hearth Waste Treatment Demonstration for Radioactive Mixed Waste /Thermal Treatment of Radioactive, Hazardous Chemical, Mixed and Medical Wastes. - Proc. of the 1994 Int. Incineration Conference, May 9-13, 1994. Adam's Mark Hotel, Houston, Texas, USA. - p.25~30.
5. H.-S. Park, H.-N. Lee, S-J. Kim, S-S. Kwon. The Pyrolysis-Melting system for Toxic waste treatment by plasma energy. Proc. of Korea Engineer's Society of Pyrolysis and Melting. 2001.11.23. -p.144~155.