

Contribution of Plasma Technology for Circular Economy

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Abstract

The circular economy is new business model that is relating social development and one of the top priority policies in EU. This is utilizing not only conventional resource recycling but also time and space. Plasma technologies has been widely contributing to many pollution control such as NO_x, SO_x, soots, VOC, other harmful gases reduction, wastewater treatment, multiple waste treatment etc. This article review how plasma technology contribute not only technologies but also social issues.

1. Preface

In Japan, various science and technology policies are being developed based on Society 5.0 that promotes necessary technological development in anticipation of a possible society in the future, such as a labor shortage that may occur in an aging society and a response to a digital society that spreads all over the world. On the other hand, the United Nations has set 17 SDGs goals and provides guidelines for creating a better future. Under such circumstances, circular economy is a policy that is being developed mainly in Europe. This is a measure that includes efficient use of time and space, instead of recycling centered on conventional products.

Although such plasma technology has been used in many fields, in this presentation, what plasma technology is what can contribute to building a better future society, explains what kind of expectations have been asked.

2. What is Circular economy and how relating Plasma Technologies

The concept of circular economy will be introduced under the new action plan aim to make sustainable products. The consumers and public buyers in EU focus on the sectors that use most resources. The potential for circularity is high such as: electronics and ICT, batteries and vehicles, packaging, plastics, textiles, construction and buildings, food, water etc. Also nutrients ensure from waste less waste and make circularity work for people, regions and cities lead global efforts on circular economy as shown in Fig.1.

Plasma technologies has been widely contributing to many pollution control such as NO_x, SO_x, soots, VOC, other harmful gases reduction, wastewater treatment, multiple waste treatment etc. Conventional plasmas are classified into low pressure ($p < 10$ Torr), low temperature ($N_p < 1000K$) plasmas, or high pressure $p < 100$ torr high temperature ($< 1000K$). The reason why plasma became the target of industrial application is that the region that was conventionally considered to be corona discharge was reviewed as low-temperature and high-pressure plasma. The low-temperature and

high-pressure plasma is applied to an ozonizer, exhaust gas treatment, material surface treatment, etc., and is widely used industrially.

3. Example of Old tires treatment using Plasma torch

For the treatment of old tires and plastics, a method of burning with cement or kiln is adopted in addition to landfill, but the release of heavy metals into the atmosphere is a problem. Among the metal components of old tires, sulfur is the cause of black smoke, and zinc is the largest pollution problem among the metal components. By using a plasma torch method in which powdered old tires are injected into high-temperature plasma together with water vapor for processing, it is possible to produce hydrocarbon gases such as methane and acetylene as by-products. These hydrocarbon gases can be used as reduction gas for steelworks and ignition gas for thermal power plants. The components of the metal contained in the tire are concentrated in the ash. These ash are collected by a ceramic in the high temperature part and a metal filter in the low temperature part. In the case of plastic, gas separation treatment such as hydrochloric acid is one of the problems. The plasma torch type sludge treatment equipment is the same as the above-mentioned ash extinction, but since 95% of the metal component is iron, this iron content is important because slag can be reused as a building material. It is a process.

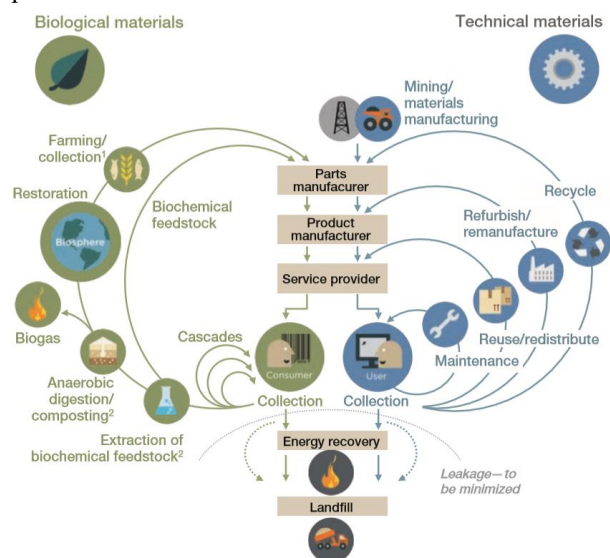


Fig.1 Concept of circular economy

Source: http://WEF_ENV_TowardsCircularEconomy_Report_2014.pdf
References

1. Yoshinobu Kawai et.al., "Industrial Plasma Technology: Applications from Environmental to Energy", Technologies, Wiley-VCH; 2010