CHAPTER 4

EXPERIMENTAL SETUP

The Radio Frequency Inductively Coupled Plasma (RF-ICP) reactor has been used for the fabric modification. The main component of this reactor was designed and constructed by Onanong Chamlek [33]. However, a new substrate holder was designed to use in this work (see section 4.3). In this chapter, the reactor components will be briefly presented in the first section. Then, the type of fabrics and fabrics preparation will be described.

4.1 The reactor

The vacuum system consists of cylindrical vessel made from stainless steel, ensambled with several ports for gas feeding line and plasma diagnostic equipments. The gas evacuation is achieved by Edwards ACX70 turbomolecular pump backed by Edward RV12 rotary vane pump where a base pressure of 2×10^{-5} Torr can be achieved. After the base pressure is reached, the SF_6 gas is entered the chamber via mass-controller (Dwyer GFC 2103-series). The SF_6 gas was provided by Bangkrauy power plant (purity of 99.7 %). The pressure during the process is monitored by a Pinary gauge while the pressure during turbomolecular pump working is monitored by a Pinning gauge.

4.2 The RF power coupling modules

The RF power coupling modules consist of; (a) the RF generator (Dressler Model with maximum of power 1000W) used to produce 13.56 MHz. This frequency is allowed for industrial, scientific, and medical used by international communications authorities [23], (b) the impedance matching network consists of variable capacitor (80 - 1000 pF) and a inductor (planar coil). The impedance matching network is used to match the source's output (RF generator impedance of 50Ω) with the load impedance of the discharge (plasma impedance approximately of 1Ω). The schematic diagram of RF-ICP system is shown in Fig. 4.1.

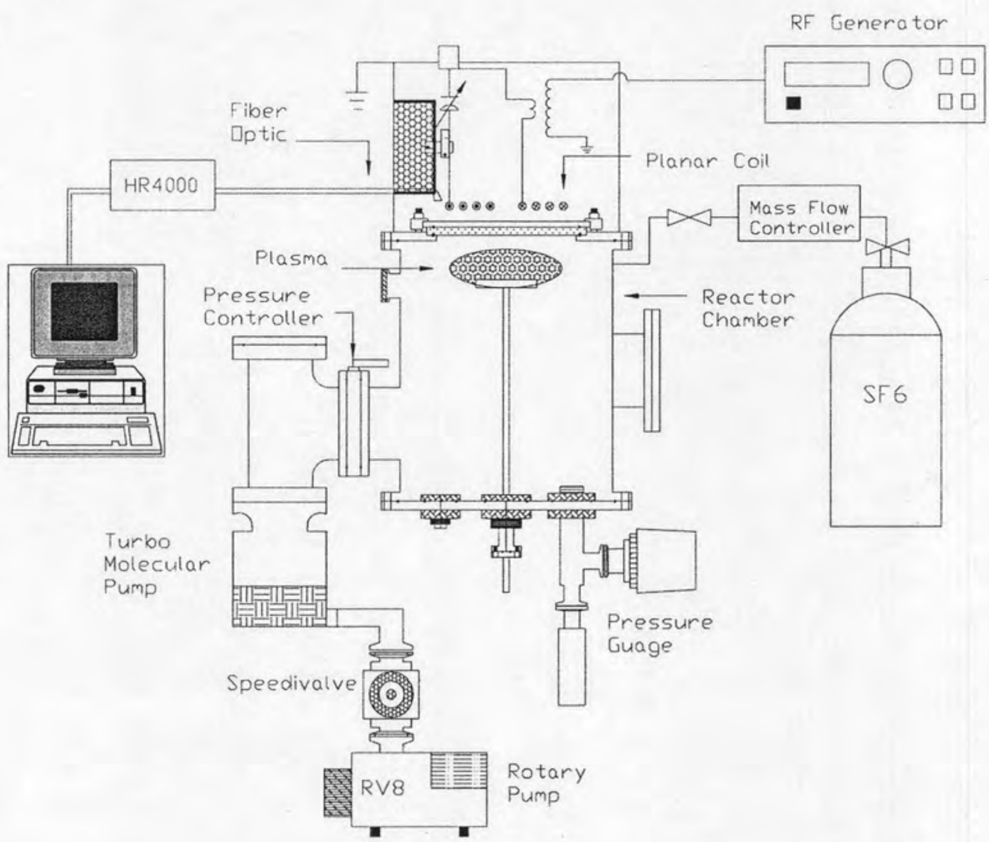

Figure 4.1: Schematic diagram of RF-ICP system.

4.3 The Substrate Holder

A 800 mm diameter stainless steel substrate holder is designed and constructed for holding the fabrics, as shown in Fig. 4.2. It is mounted axially in the reactor and can be adjusted vertically from the planar coil.

(a) (b)

Figure 4.2: The photograph of the top view (a) and the side view of sample holder (b).

4.4 Type of Fabrics and Fabrics Preparation

In this work, the polyethylene terepthalate (PET) (74.8 g/m^2), Thai silk (112 g/m^2), mixed Thai silk (84.2 g/m^2) and cotton (157.2 g/m^2) are used to study their property modification by plasma process. The photograph of sample fabrics is shown in Fig. 4.3. Prior to plasma treatment, all fabrics were cleaned with dilute detergent, repeatedly washed with distilled water and dried in air atmosphere. Then, all fabrics are sewed into one piece as illustrated in Fig. 4.4(a) in order to treat all fabrics under the same plasma condition. The total dimension of the prepared fabrics is 12$\times$12 cm^2 and treatment area is 113 cm^2 as seen in Fig. 4.4(b). A sample consisting four types of fabric was held by a sample holder, placed 2 cm below the quartz plate. Treatment conditions for fabric properties modification are showed in Table 4.1.

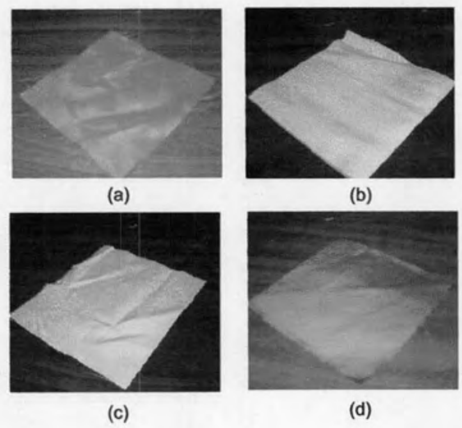

Figure 4.3: The photograph of fabric used for properties modification by plasma process (a) PET, (b) Thai silk, (c) mixed Thai silk and (d) cotton fabrics, respectively.

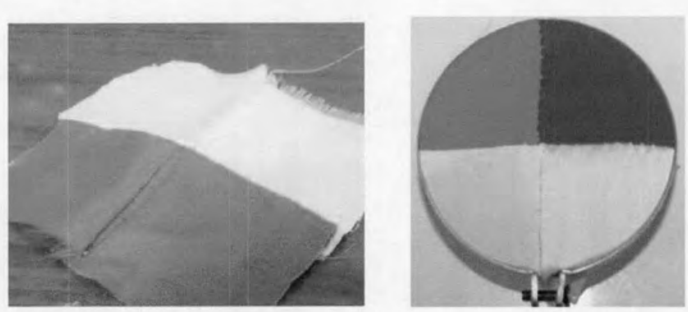

Figure 4.4: The photograph of four type of fabric which are sewed into one piece before treating by plasma (a) and total treatment area after placed on substrate holder (b).

Table 4.1: The treatment conditions for fabric properties modification.

Sample number	Pressure (Torr)	RF power (watts)	Treatment time (min)
1	-	untreated	-
2	0.005	25	1
3	0.005	25	5
4	0.005	50	1
5	0.005	50	5
6	0.005	75	1
7	0.005	75	5
8	0.05	25	1
9	0.05	25	5
10	0.05	50	1
11	0.05	50	5
12	0.05	75	1
13	0.05	75	5
14	0.5	25	1
15	0.5	25	5
16	0.5	50	1
17	0.5	50	5
18	0.5	75	1
19	0.5	75	5
20	1	25	1
21	1	25	5
22	1	50	1
23	1	50	5
24	1	75	1
25	1	75	5