

ABSTRACT

The breakdown phase of plasma in a tokamak is a crucial stage before achieving fusion conditions. This stage will influence the quality of electron production, plasma purity, plasma stability, and more. This study aims to determine the optimum parameters during the breakdown phase in the GOLEM tokamak by examining the effects of gas pressure and transformer core voltage on breakdown voltage, discharge duration, and maximum plasma current. The research is conducted remotely using a computer to access the website connected to the GOLEM tokamak. Eighty discharge data points from the GOLEM tokamak website database are plotted into graphs. The optimal gas pressure falls within the range of 7-15 mPa. In this pressure range, the discharge duration (T_{dis}) and maximum plasma current ($I_{p, max}$) reach relatively the highest values (11,59 – 13,56 ms; 2,6 – 3,82 kA). An increase in the transformer core voltage (U_{CD}) results in an elevation of breakdown voltage ($U_{breakdown}$), discharge duration (T_{dis}), and maximum plasma current ($I_{p, max}$).

Keywords: *Fusion, Plasma, GOLEM Tokamak, Breakdown phase, Paschen curve, Relationship between Pressure and Breakdown Voltage.*

LAMPIRAN A
DATA DISCHARGE EKSPERIMEN TOKAMAK GOLEM

No	Shot	Input				Output			
		p (mPA)	U_{BT} (V)	U_{CD} (V)	T_{CD} (ms)	T_{dis} (ms)	$I_{p,max}$ (kA)	V_{BD} (V)	Terbentuk Plasma
1	41834	21,7	1000	450	0	0,22	0,13	11,551	Ya
2	41835	18,6	1000	450	0	4,79	1,31	11,287	Ya
3	41836	21,1	1000	450	0	3,64	1,73	11,425	Ya
4	41837	16,3	1000	450	0	3,77	1,87	11,702	Ya
5	41839	14,5	1000	450	0	3,73	1,92	11,536	Ya
6	41840	10,7	1000	450	0	3,91	1,01	11,728	Ya
7	41842	10,3	1000	450	0	4,12	2,31	11,477	Ya
8	41843	8,93	1000	450	0	11,59	2,3	11,862	Ya
9	41844	8,98	1000	450	0	11,8	2,42	11,66	Ya
10	41846	9,17	1000	450	0	5,23	2,48	11,723	Ya
11	41848	13,4	1000	450	0,35	9,09	1,83	11,418	Ya
12	41849	14,3	1000	450	0,35	1,72	1,24	11,505	Ya
13	41850	16,7	1000	450	0,35	1,69	1,23	11,51	Ya
14	41852	21,5	1000	450	0,35	4,85	2,24	12,037	Ya
15	41853	22,7	1000	450	0,35	11,64	2,13	12,028	Ya
16	41863	8,82	1000	450	0	1,45	0,97	11,692	Ya
17	41865	14,9	1000	450	0	13,11	2,47	11,472	Ya
18	41867	0,98	1000	450	0	-	-	13	Tidak
19	41868	15,4	1000	450	0	5,71	2,43	11,359	Ya
20	41919	16,7	900	500	0	6,14	2,2	12,173	Ya
21	41926	5,29	1000	500	0	9,88	2,06	12,94	Ya
22	41927	5,1	1000	500	0	4,89	2,14	12,996	Ya
23	41928	9,28	1000	500	0	5,2	2,54	12,4	Ya
24	41936	11,8	1000	450	0	2,01	1,49	11,28	Ya
25	41937	17,7	1000	450	0	6,08	2,14	11,268	Ya
26	41938	17,8	1000	400	0	1,34	0,94	10,855	Ya
27	41940	19,3	1000	450	0	1,44	1,18	11,696	Ya
28	41941	20,9	1000	450	0	1,45	1,16	11,641	Ya
29	41945	16	1000	450	0	13,36	2,52	11,7	Ya
30	41946	16,2	1000	450	0	1,48	1,35	11,818	Ya
31	41949	16,9	1000	450	0	1,44	1,06	11,29	Ya
32	41951	18,7	1000	450	0	13,56	2,19	11,707	Ya
33	41958	5,24	1000	450	0	2,02	0,92	11,43	Ya
34	41959	10,6	1000	450	0	3,21	1,91	11,23	Ya
35	41960	12,4	1000	450	0	6,89	2,27	11,177	Ya
36	41961	14,3	1000	450	0	5,37	2,1	11,09	Ya

37	41962	10,8	1000	450	0	6,12	2,08	11,32	Ya
38	41963	1,08	1000	450	0	-	-	13,447	Tidak
39	41964	13,4	1000	450	0	11,95	2,41	11,446	Ya
40	41967	15,5	1000	500	0	12,41	2,61	12,3	Ya
41	41968	14,5	1000	500	0	7,02	2,6	12,148	Ya
42	41969	13,4	1000	500	0	12,24	2,95	12,2	Ya
43	41970	12,2	1000	500	0	11,72	2,87	12,053	Ya
44	41971	14,1	1000	500	0	8,03	2,9	12,391	Ya
45	41972	25,8	900	500	0	6,93	2,33	12,177	Ya
46	41975	23,4	1000	500	0	7,62	2,69	12,09	Ya
47	41976	15,3	900	450	0	7,83	2,56	11,088	Ya
48	41977	17,2	900	500	0	7,89	2,92	12,034	Ya
49	41979	37,9	900	500	0	6,84	2,25	12,65	Ya
50	41980	20,3	1000	450	0	7,79	2,56	11,234	Ya
51	41982	18,5	1000	400	0	7,81	2,24	10,715	Ya
52	41983	13,5	900	400	0,5	8,1	2,55	10,712	Ya
53	41989	19,8	900	350	0,5	5,74	1,4	9,935	Ya
54	41990	9,77	900	350	0,5	7,46	1,67	9,678	Ya
55	41991	9,43	900	350	0,5	7,62	2,05	9,682	Ya
56	41992	9,07	900	350	0,5	7,78	2,07	9,755	Ya
57	41993	9,06	900	350	0,5	7,77	2,07	9,74	Ya
58	41994	9,03	900	350	0,5	7,77	2,15	9,898	Ya
59	41995	8,95	900	350	0,5	7,99	2,32	10,262	Ya
60	41996	8,95	900	350	0,5	7,64	1,86	9,662	Ya
61	41997	8,9	900	350	0,5	9	2,14	9,847	Ya
62	41998	8,88	900	350	0,5	8,31	2,24	9,979	Ya
63	41999	8,89	900	350	0,5	8,44	2,34	10,054	Ya
64	42000	8,88	900	350	0,5	8,44	2,03	10,353	Ya
65	42002	8,93	900	350	0,5	8,88	2,29	9,97	Ya
66	42003	9,01	900	350	0,5	8,17	2,22	9,59	Ya
67	42004	8,96	900	350	0,5	8,62	2,45	10,184	Ya
68	42005	8,97	900	350	0,5	8,3	2,12	9,73	Ya
69	42006	8,93	900	350	0,5	9,2	2,14	9,72	Ya
70	42009	11,4	1000	350	0	8,6	2,22	9,824	Ya
71	42013	31,1	900	450	0	6,7	1,92	11,76	Ya
72	42014	21,8	900	450	0	7,78	2,39	11,224	Ya
73	42030	0,88	900	500	0	-	-	14,45	Tidak
74	42032	2,49	900	500	0	-	-	14,196	Tidak
75	42033	3,24	900	500	0	-	-	14,379	Tidak
76	43409	10,8	1000	500	0	9,98	3,82	11,984	Ya
77	43456	10,3	1000	400	0	9,08	2,82	10,713	Ya
78	43457	8,33	1000	450	0	9,25	3,36	11,588	Ya
79	43509	15,8	1000	500	0	8,55	3,25	12,214	Ya
80	43518	24,2	1000	450	0	6,56	1,69	12,081	Ya