

TABLE S8-34

USPTO patents and patent families granted in thermal processes and apparatus, by region, country, or economy: 1998–2018

(Number)

Region, country, or economy	1998		1999		2000		2001		2002		2003		2004		2005		2006		2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017		2018		
	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families			
World	1,648	6,056	1,755	7,676	1,766	6,039	1,842	5,434	1,653	5,298	1,614	5,623	1,505	6,236	1,427	6,752	1,489	8,689	1,242	8,575	1,038	7,443	1,071	7,451	1,488	7,346	1,458	8,505	1,681	10,429	1,904	10,888	2,088	11,539	2,238	10,899	2,362	13,115	2,941	14,359	2,989	13,712	
North America	943	740	951	740	954	672	995	676	906	603	920	604	868	566	797	484	847	478	659	281	547	281	588	277	588	804	373	759	349	886	1,097	419	1,145	459	1,194	471	1,415	518	1,393	467			
Canada	69	63	59	54	64	47	63	40	48	38	45	32	52	48	49	31	58	33	45	44	36	35	36	30	49	30	37	24	53	32	51	28	48	31	63	32	78	31	78	36	77	36	
Mexico	1	0	3	3	7	6	5	4	5	3	2	1	2	2	1	0	5	2	3	0	2	0	0	0	2	1	6	0	2	1	0	7	0	1	4	2	1	8	17	8	8		
Puerto Rico	0	0	1	0	1	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
United States	872	692	887	683	883	618	927	632	853	562	871	571	814	516	747	453	783	444	611	320	510	245	550	248	753	342	716	325	831	315	982	351	1,042	387	1,077	425	1,114	428	1,329	465	1,309	423	
All others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Central and South America	3	1	3	1	13	8	17	3	7	2	8	7	5	5	2	5	5	5	1	6	1	8	4	13	5	22	6	20	3	12	9	15	3	12	7	13	5	4	9	14	6	15	
Argentina	0	0	0	0	1	0	0	0	0	0	2	3	0	0	0	1	0	0	0	1	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Brazil	1	0	1	1	12	5	16	2	7	1	3	3	3	3	1	2	4	1	5	1	8	1	3	12	4	21	4	19	3	13	2	10	8	11	6	11	3	8	13	5	13	5	13
All others	2	1	2	0	1	2	1	1	1	1	3	1	2	2	1	2	1	4	0	2	0	0	1	12	1	4	0	19	3	10	8	11	6	11	3	8	13	5	13	5	13		
Europe	316	1,626	342	1,599	348	1,609	354	1,464	287	1,524	302	1,521	251	1,721	216	1,511	226	1,359	216	1,394	175	1,358	172	1,463	232	1,392	253	1,344	315	1,535	360	1,526	437	1,443	471	1,460	443	1,285	557	1,571	565	1,564	
EU	280	1,140	296	1,185	308	1,211	320	1,097	259	1,082	281	944	239	1,086	202	1,009	207	902	201	865	162	797	153	802	217	895	229	930	299	1,127	331	1,031	403	1,033	437	1,460	443	1,285	557	1,571	565	1,564	
Austria	4	58	6	63	5	55	10	53	3	79	4	64	4	31	2	37	5	37	5	24	4	42	5	47	4	66	6	39	7	69	7	54	10	45	9	36	11	43	18	37	14	30	
Belgium	3	4	4	6	5	6	7	3	4	7	4	6	2	6	2	5	3	4	1	5	1	6	2	4	2	6	2	8	3	7	6	11	15	5	10	7	9	15	23	14	35		
Denmark	12	12	8	7	10	9	11	3	5	11	6	10	5	15	5	12	3	16	10	4	16	7	10	2	9	5	7	15	15	14	10	22	14	17	14	16	27	22	17	18	18		
Finland	15	39	8	30	6	24	11	24	6	28	9	29	16	31	7	20	6	12	5	27	4	17	3	23	3	23	9	32	10	33	9	34	8	30	16	43	11	26	11	26	15	33	
France	50	235	59	219	54	213	60	215	53	151	45	123	34	145	23	142	34	180	31	154	21	135	18	114	27	134	30	98	41	277	43	220	55	241	60	211	72	176	79	246	76	306	
Germany	103	357	113	372	120	373	118	393	113	413	125	391	101	369	89	368	96	350	93	319	76	256	72	234	102	235	107	206	116	245	142	263	146	248	162	256	136	187	226	188	204		
Hungary	0	5	2	3	2	4	1	4	0	4	0	1	0	1	2	0	2	0	2	1	0	2	0	2	0	0	1	2	0	2	0	6	2	7	0	6	1	4	1	1	3	2	
Ireland	1	5	0	4	3	1	2	0	0	1	0	1	0	2	1	0	2	0	1	0	6	1	12	2	6	1	4	10	3	4	4	10	3	6	3	7	3	4	5	5	5		
Italy	22	132	21	198	24	225	29	107	21	99	26	64	19	216	21	117	16	22	19	24	12	27	15	30	26	54	18	98	26	84	30	98	17	35	17	50	26	37	20	56	187	59	143
Netherlands	11	63	5	66	11	85	8	72	8	57	11	60	10	67	10	54	10	65	5	55	10	49	6	43	11	55	10	64	12	72	14	58	16	41	12	53	20	50	18	49	26	18	
Spain	5	29	3	36	5	35	4	31	5	30	6	32	4	31	2	59	2	57	3	65	2	71	3	68	4	105	4	120	13	100	14	100	13	139	21	93	14	12	88	11	59		
Sweden	22	47	27	44	28	38	25	53	13	73	14	64	15	69	10	32	10	46	9	38	11	35	11	53	12	46	15	23	17	28	20	23	28	21	32	20	24	35	31	26	43		
United Kingdom	30	53	36	44	34	55	35	35	25	38	26	35	23	39	25	59	19	29	17	23	16	23	14	33	13	40	17	41	31	55	26	44	43	31	40	49	39	76	48	53	45	61	
All others	4	100	3	93	2	89	4	97	4	87	4	63	5	65	2	102	3	82	2	118	2	114	2	129	6	116	4	163	7	148	14	187	15	147	11	199	13	147	20	193			
Other Europe	35	486	47	414	39	398	34	367	27	442	20	576	12	635	13	502	18	457	15	529	13	561	19	662	14	497	24	414	16	408	33	495	33	410	34	483	35	303	39	440	47	415	
Former Soviet Union	1	14	3	15	1	9	2	19	0	30	1	64	1	203	1	70	0	32	0	74	0	79	1	112	0	95	0	66	0	53	0	66	0	46	0	55	0	43	0	44	1	35	
Norway	4	14	6	11	7	11	4	9	6	10	1	15	2	7	2	7	3	9	2	9	2	8	3	5	1	10	0	9	2	6	4	12	9	4	9	4	9	5	11	5	4		
Russia	4	434	4	370	5	352	4	306	2	372	1	463	2	402	2	405	2	385	2	418	0	441	3	521	3	318	2	392	1	326	3	392	1	326	1	392	3	222	5	356	4	338	
Switzerland	27	22	34	17	23	25	23	30	18	29	18	31	8	21	8	18	14	30	10	25	11	28	10	20	9	15	18	15	12	19	18	19	26	27	28	22	27	26	25	28	29	33	
All others	0	2	0	2	4	2	0	3	0	1	0	3	1	1	0	2	1	1	3	0	5	1	4	2	6	4	3	6	0	4	3	6	4	2	4	4	3	6	4	2	8	5	5
Asia	370	3,647	429	5,284	417	3,696	445	3,250	416	3,126	365	3,463	363	3,908	388	4,711	402	6,631	347	6,771	301	5,756	294	5,664	433	5,521	413	6,756	447	8,479	473	8,919	514	9,613	571	8,914	667	11,307	894	12,218	968	11,638	

TABLE S8-34

USPTO patents and patent families granted in thermal processes and apparatus, by region, country, or economy: 1998–2018

(Number)

Region, country, or economy	1998		1999		2000		2001		2002		2003		2004		2005		2006		2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017		2018	
	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families	USPTO patents	Patent families		
China	9	23	5	28	10	99	15	86	11	81	15	288	17	377	16	399	14	487	19	558	25	964	19	1,756	33	1,568	35	1,862	44	2,647	43	2,419	55	2,669	52	4,507	77	6,027	95	7,170	116	7,135
India	1	1	1	2	2	3	0	0	0	0	2	2	1	1	2	2	2	2	2	4	2	2	2	2	4	5	4	6	3	10	2	9	6	8	4	12	5	15	4	19	10	
Japan	243	2,986	305	3,339	315	2,869	319	2,666	275	2,522	244	2,175	201	2,413	227	2,699	214	3,467	177	3,346	149	3,000	138	2,860	235	2,716	226	3,226	221	3,512	233	3,786	266	4,274	304	2,506	360	3,179	515	2,980	523	2,645
Malaysia	0	0	0	0	1	0	0	0	0	0	0	1	1	2	0	1	0	8	0	6	0	0	0	2	0	3	0	3	1	0	5	1	5	0	5	0	1	3	2	2	7	
Singapore	0	0	1	1	2	1	1	2	4	2	2	1	2	2	0	2	3	0	0	1	0	1	2	0	3	1	0	2	1	0	2	4	1	2	0	1	0	1	1	0		
South Korea	81	590	81	1,859	58	679	46	398	60	441	47	913	78	1,012	86	1,505	104	2,479	106	2,669	81	1,653	78	889	102	1,083	107	1,537	118	2,156	126	2,495	114	2,430	133	1,692	158	1,822	199	1,766	223	1,611
Taiwan	34	44	36	55	30	42	62	96	64	78	54	78	64	98	56	102	64	186	43	187	44	136	53	153	55	146	40	123	54	158	59	208	63	226	70	197	58	268	65	289	80	228
All others	1	1	1	0	0	2	2	2	1	1	0	5	0	2	0	0	0	2	0	1	0	1	1	3	1	2	0	2	0	2	3	0	2	3	3	2	1	4	2	6	3	2
Middle East	3	2	12	4	11	7	9	7	10	8	7	3	7	4	12	8	5	3	5	8	7	4	2	4	6	5	11	2	11	7	20	13	19	10	27	11	29	18	44	21	33	9
Israel	11	3	11	3	7	2	7	2	7	2	6	3	6	2	11	4	3	1	3	2	5	1	2	1	6	2	10	0	5	12	2	15	12	3	15	3	12	17	2	14	1	
All others	0	1	1	2	4	5	2	5	3	6	0	0	1	3	1	4	2	2	2	6	2	3	1	3	1	4	2	5	6	10	11	7	9	12	8	17	15	27	20	19	8	
Africa	0	9	0	8	4	14	3	9	2	11	1	13	4	5	3	5	1	8	0	6	8	0	6	1	8	1	7	2	7	3	11	6	7	13	1	2	4	1	4	4	6	4
South Africa	0	6	0	4	4	10	2	4	1	4	2	4	2	3	2	2	1	3	2	7	0	6	1	7	1	5	2	0	2	3	4	0	4	1	0	4	0	4	0	6	0	
All others	0	3	0	5	0	4	1	4	1	7	0	9	2	2	1	1	0	2	1	2	0	1	0	1	0	0	7	0	5	0	6	0	12	0	2	0	0	1	4	0	4	
Australia and Oceania	14	7	19	16	20	20	19	20	26	20	11	13	7	24	10	20	5	18	11	18	7	26	10	19	7	26	13	25	17	38	10	29	13	28	15	28	20	28	17	13	18	14
Australia	13	7	18	15	16	19	17	20	24	20	9	13	6	24	9	19	5	18	11	18	7	26	8	18	7	26	10	25	14	37	8	29	12	28	13	28	15	28	13	12	16	13
New Zealand	2	0	1	1	4	0	1	0	2	0	2	0	1	0	1	1	0	0	1	0	0	0	1	1	0	0	3	0	3	0	2	0	1	0	2	0	4	1	3	1	3	1
All others	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unclassified	0	9	0	23	0	14	1	6	0	4	0	0	1	4	0	9	0	189	0	6	0	4	0	3	1	1	2	0	0	0	0	0	0	1	12	1	1	0	0	0	0	

EU = European Union; USPTO = U.S. Patent and Trademark Office.

Note(s)

USPTO patents are allocated according to patent inventorship information. USPTO patents are fractionally allocated among regions, countries, or economies based on the proportion of residences of all named inventors. Patents are classified under the World Intellectual Property Organization (WIPO) classification of patents, which classifies International Patent Classification (IPC) codes under 35 technical fields. IPC reformed codes take into account changes that were made to the WIPO classification in 2006 under the eighth version of the classification and were used to prepare these data. However, because PatentsView only provides the original IPC codes as they appeared on patents and not the IPC reformed codes, current Cooperative Patent Classification codes on patents were converted back to the most recent IPC classification to prepare these statistics. Fractional counts of patents were assigned to each technological field on patents to assign the proper weight of a patent to the corresponding technological fields under the classification. International Patent Documentation (INPADOC) patent families across all patent offices covered in the Worldwide Patent Statistical Database (PATSTAT) are counted according to the year of the first granted patent in the patent family. Patent families are allocated according to patent inventorship information found on the priority patent of the INPADOC patent families. To account for missing ownership information in PATSTAT for some offices, a method designed by de Rassenfosse et al. (2012) is used to fill in missing information on priority patents using information in successive filings within the patent families (see technical documentation for details). Patent families are fractionally allocated among regions, countries, or economies based on the proportion of residences of all named inventors. Because of data coverage issues for some patent offices in PATSTAT, statistics for some countries may be underestimated partially for some years or across the whole trend. Countries with identified issues include India (missing data) and South Africa (no data for 2018). For Italy, because of data gaps regarding information on granted patents, patent applications are used instead, which slightly overestimates Italy's output and creates a small shift in the year for which its output is accounted. The EU includes 28 member countries. China includes Hong Kong.

Source(s)

Science-Matrix; PATSTAT, accessed April 2019; PatentsView, USPTO, accessed June 2019.