

표 1. CFC대체 신냉매 미국특허 현황 (1984년 - 1993년)

| | 특허번호 | 출원인 | 특 허 내 용 | 비 고 |
|----|--------------------|-------------------------------|--|---------|
| 1 | USP4,482,465(1984) | Phillips Petrol. Co.(미국) | Hydrocarbon-halocarbon refrigerant blends | |
| 2 | USP4,810,403(1989) | DuPont | R-12대체, 22+152a+114, 22+152a+142b+114, 22+152a+124, 22+142b+114 etc, 125+152a+318 | (US043) |
| 3 | USP4,812,250(1989) | Ins. Francais de Petrole(프랑스) | R23+R141b+(c) | |
| 4 | USP4,923,626(1990) | Daikin | 22 + 143a | |
| 5 | USP4,957,652(1990) | Daikin | 123+(124,125,134a,142b,143a,152a) | |
| 6 | USP4,985,168(1991) | Daikin | (CF ₃ CF ₂ CH ₂ Cl,CF ₂ ClCH ₂ CF ₃) + (123,141b) | |
| 7 | USP4,983,312(1991) | Daikin | 134a+(22,142b) | |
| 8 | USP4,997,589(1991) | Allied Signal | 152+123(냉매,Solvent,Blowing agent) | |
| 9 | USP5,035,823(1991) | Daikin | 143a + (124, 134a) | (US01) |
| 10 | USP5,059,338(1991) | Matsushita | 12대체,23+22+(134,124,124a,123,123a) | |
| 11 | USP5,080,823(1992) | Atochem (프랑스) | 저온냉매 Halon1301대체, 143a(70.6wt%)+290(29.4wt%) | (US02) |
| 12 | USP5,087,381(1992) | Daikin | USP4,957,652 (1990)와 동일 | |
| 13 | USP5,108,637(1992) | Star Refrige. (영국) | (22,125) + (125, 218) + 290 | (US042) |
| 14 | USP5,151,207(1992) | Goble(미국) | 12대체, R600a + R22 + R142b | |
| 15 | USP5,182,040(1993) | DuPont | 134a + (152a, 142b, DME, RC318, 600, 600a, 227ea) | (US03) |
| 16 | USP5,185,094(1993) | DuPont | 125 + 32 + 134a | (US04) |
| 17 | USP5,211,867(1993) | Allied Signal | 125 + 143a | (US05) |
| 18 | USP5,214,929(1993) | G.H.Goble(미국) | R-12대체, R600a+R22+R142b (USP5,151,207 (1992)과 동일) | |
| 19 | USP5,232,618(1993) | DuPont | 32 + (143a, 116) | (US06) |
| 20 | USP5,234,613(1993) | DuPont | 32 + 290 | (US07) |
| 21 | USP5,236,611(1993) | DuPont | 218 + 143a | (US08) |
| 22 | USP5,248,433(1993) | DuPont | 218 + 116 | |
| 23 | USP5,254,279(1993) | Sanyo | 500/502대체, 142b + 218 | |
| 24 | USP5,262,077(1993) | DuPont | 134a+152a+(124, 124a,227ca, 227ea) | (US09) |

표 2. CFC대체 신냉매 미국특허현황 (1994년 - 1996년)

| | 특허번호 | 출원인 | 특 허 내 용 | 비 고 |
|----|--------------------|-----------------------------|---|---------|
| 25 | USP5,277,834(1994) | DuPont | 125+143a+(22,134a,134,124,124a,227ea, 227ca,C216), 22+125+(170,R600,600a, DME,1270,32) etc, 125+116+134a | (US10) |
| 26 | USP5,290,466(1994) | DuPont | 32 + 134a + 134 | (US011) |
| 27 | USP5,294,359(1994) | Allied Signal | 32 + 134a + (152a,143a,290,DME,) | (US012) |
| 28 | USP5,304,319(1994) | 마쓰시다 | 22대체, (134a,134)+152a+(23,32,125, 143a) | (US041) |
| 29 | USP5,340,490(1994) | Allied Signal | 23 + CO ₂ , 23 + 116 + CO ₂ | (US013) |
| 30 | USP5,360,566(1994) | Intermagnetics General (미국) | CO ₂ +290+134a+600a, CO ₂ +290+134a+ n-Hexane, CO ₂ +ethane+134a+600a CO ₂ +ethane+290+134a+600a, ethane+ 290+134a+600a, ethane+134a+600a, CO ₂ +propylene+134a+600a | |
| 31 | USP5,370,811(1994) | 마쓰시다 | 22대체, 134a+HFCs, USP038과 동일 (134a,134)+2 of (23,32,125,143a) | (US040) |
| 32 | USP5,403,504(1995) | DuPont | 125 + 32 | (US014) |
| 33 | USP5,417,871(1995) | DuPont | 32+(600,600a,propylene,C270), 125+ (propylene,C270), 134a+(290,C270), 143a+(DME,propylene), 152a+(290, 600,600a,C270), 116+(290,C270), 227ca+(600,C270,DME,600a,290), 227ea+(600,c270,600a,290) | (US015) |
| 34 | USP5,425,890(1995) | APD Cryogenics (미국) | 134a + 124 + 600 | |
| 35 | USP5,429,760(1995) | Solvay | 23 + 134a | (US016) |
| 36 | USP5,433,879(1995) | 마쓰시다 | 152a+2 of (23,32,125,134a,134,143a) | (US039) |
| 37 | USP5,438,849(1995) | 마쓰시다 | (134a,134) + 2 of (23,32,125,143a) | (US038) |
| 38 | USP5,458,798(1995) | DuPont | (134a,134)+methylbutane,134+n-C ₅ , 23+290, 236fa+(601,c-pentane), 236ea+cyclopentane | (US037) |
| 39 | USP5,474,695(1995) | Elf Atochem | 143a + 218 + 290 | (US017) |
| 40 | USP5,492,643(1996) | K.B.Ruello(미국) | 12대체, 142b + 134a | |
| 41 | USP5,512,197(1996) | Caltech | 12대체, 134a+(124,142b) 134a + 2 or 3 of (124, 142b, 152a) | |
| 42 | USP5,523,011(1996) | Caltech | USP5,512,197과 동일 | |

표 3. CFC대체 신냉매 미국특허현황 (1996년 - 1997년)

| | 특허번호 | 출원인 | 특 허 내 용 | 비 고 |
|----|--------------------|------------------------|--|---------|
| 43 | USP5,538,658(1996) | DuPont | CF ₃ OCHF ₂ (E125)+(NH ₃ ,DME,C270, 290, Propylene) | |
| 44 | USP5,538,659(1996) | DuPont | 227(hexafluoropropane)+HFC(227, 245,254,263,272,281,(CF ₃) ₂ CHCH ₃) | |
| 45 | USP5,538,660(1996) | Elf Atochem | 12대체, 32 + 134a + (14, 218) | (US018) |
| 46 | USP5,552,074(1996) | DuPont | E134 + (600,600a) etc | (US019) |
| 47 | USP5,558,810(1996) | DuPont | 245 + Fluorinated propane, etc | |
| 48 | USP5,562,853(1996) | DuPont | 1,1,2,2,3,3,4,4-Octafluorobutane compositions | |
| 49 | USP5,562,854(1996) | DuPont | Octafluorobutane compositions | |
| 50 | USP5,562,855(1996) | DuPont | Octafluorobutane compositions | |
| 51 | USP5,589,098(1996) | DuPont | 32 + 134a + 134 | (US020) |
| 52 | USP5,605,882(1997) | DuPont | a HFE + a HFC | |
| 53 | USP5,616,275(1997) | Du Pont | 236ca+(236fa,245eb,245fa,254eb,263ca, 263fb,272ca,272fb,281ea,356mmz), 236cb+(236ea,236fa,245fa,254cb,254eb, 263fb,272ca,272fb,281ea,281fa), 236ea+(236fa,245cb,263fb,272ca,272fb, 281ea,281fa), 236fa+(245ca,245eb, 254ca,254cb,254eb,272ca,272ea,281ea) | (US044) |
| 54 | USP5,616,276(1997) | DuPont | 125+143a+1 or more of (22,134a,134, 124,124a,227ea,227ca,C216), 22 + 125 +1 or more of (ethane,600,600a,DME ,propylene,32), 22+1 of ((143a+134a) ,(290+125),(143a+218)),125+116+134a | (US021) |
| 55 | USP5,622,645(1997) | C.Gu(중국) | (600a,600)+22+152a, 22+152a+134a+C 318,22+152a+134a+290,22+152a+C318, 22+152a+142b+318, 22+1270+152a | |
| 56 | USP5,624,595(1997) | E.Sato & S.Oho (일본&한국) | 600+ethyl ether+dimethyl polysilane (silicone oil) | |
| 57 | USP5,626,790(1997) | Du Pont | 143+((CF ₃) ₂ NF,(CF ₃) ₃ N,N(CHF ₂) ₂ (CF ₃),N(CH ₂ F)(CF ₃) ₂ , SF ₅ CF ₂ H, SF ₅ C ₂ F ₅ , 236ca,236cb,236ea,254cb,254eb,263fb, 272ca,281ea,281fa,338mf,4310mee,600, C270, 600a, 290) | |
| 58 | USP5,643,492(1997) | DuPont | 125 + 32 + 134a | (US023) |

표 4. CFC대체 신냉매 미국특허 현황 (1997년 - 1998년)

| | 특허번호 | 출원인 | 특 허 내 용 | 비 고 |
|----|--------------------|--------------------------|--|---------|
| 59 | USP5,645,754(1997) | DuPont | (236ca,236cb,236ea,236fa) + (600, C270, DME, 600a, 290) | (US034) |
| 60 | USP5,648,016(1997) | DuPont | Fluoromethyl trifluoromethyl ether and 152a, 134E+(227ea,236ea,245cb, 32,125,134,134a,143,143a,152a) etc | (US033) |
| 61 | USP5,648,017(1997) | DuPont | 134+32, 134+(318, 600, 600a, 227ea), 134a + (318, 227ea) | (US024) |
| 62 | USP5,650,089(1997) | EPA | E143a + (152a, E245) + C270 | |
| 63 | USP5,653,908(1997) | DuPont | Octafluorobutane compositions | |
| 64 | USP5,670,079(1997) | DuPont | USP5,458,798 (1995)과 동일 | (US032) |
| 65 | USP5,672,293(1997) | DuPont | 32+(600,600a,C270), (125,134a)+C270, 134a+290, 152a+(290,600,600a,C270), (227ca,227ea)+(600,600a,290,C270) | (US025) |
| 66 | USP5,672,294(1997) | Allied Signal | 1,1,1,3,3-pentafluoropropane + hydrocarbon | |
| 67 | USP5,681,501(1997) | DuPont | hydrofluoropropane | |
| 68 | USP5,688,431(1997) | Du Pont | 338q+(245ca,245ea,245eb,254ca,338mee,356mff),338mee+(245ca,245ea,254ca, 356mff), 338mf+(245ca,245ea,245eb, 254ca,263ca,272ea,272fb), 338pcc+(272ea,356mcf,365mfc,392sc,392see) | |
| 69 | USP5,688,432(1997) | 영국 | 22&12대체,125+134a+(600a,290,218) | (US026) |
| 70 | USP5,702,632(1997) | General Signal Co. | 142b + 134a + 23 + 14 + 740 | |
| 71 | USP5,705,471(1998) | DuPont | 1,1,2,2,3,3,4,4-Octafluorobutane comp. | |
| 72 | USP5,709,092(1998) | DuPont | 125 + 32 + 134a | (US027) |
| 73 | USP5,713,211(1998) | M i n n e s o t a Mining | HFE Refrigerants | |
| 74 | USP5,722,256(1998) | DuPont | 125 + 32 + 134a | (US028) |
| 75 | USP5,725,791(1998) | DuPont | 134a+152a, 134+(142b,C318,600,600a, 227ea), 134a + (C318,227ea) | (US029) |

표 5. CFC대체 신냉매 미국특허 현황 (1998년 이후)

| | 특허번호 | 출원인 | 특 허 내 용 | 비 고 |
|----|--------------------|---------------|---|---------|
| 76 | USP5,733,472(1998) | DuPont | 134a + Fluoropropane | |
| 77 | USP5,736,062(1998) | Ausimont | 125+143a+C270, 32 + 125 + 143a | |
| 78 | USP5,736,063(1998) | Allied Signal | 143a+23+(125,134,134a,227ea, 245cb) 32+23+(125,134, 134a, 227ea, 245cb) 290+23+(125,134,134a, 227ea, 245cb) | (US030) |
| 79 | USP5,744,052(1998) | DuPont | 32(50wt%) + 125(50wt%) | |
| 80 | USP5,766,503(1998) | Du Pont | 116 + (23, 744A, 744, 41) | |
| 81 | USP5,866,029(1999) | Allied Signal | 245fa+(n-Pentane,i-pentane,c-pentan e, n-Hexane, i-hexane) | |
| 82 | USP5,888,418(1999) | Morrison | 143 + E134 | |
| 83 | USP5,954,995(1999) | Goble | R-134a대 체, 227ea+152a+125, 227ea+ 125, 600a+227ea+125, 600a+227ea+ 125+134a, 245cb+125+290, 245cb+125 +290+134a,134+143a+290,227ea+143a+ 290,245cb+143a+600,245cb+E125+600, E143a+E125+600,227ea+152a+125+600 ,245cb+125,227ea+143a, 245cb+143a | (US045) |
| 84 | USP5,968,406(1999) | Du Pont | 134+(152a,142b,C318,600,600a, 227ea) | (US046) |
| 85 | USP6,001,273(1999) | Minor | 32+(600a,600,propylene,C270), 125+ (propylene,C270),134+290,134a+C270, 143a+propylene, 152a+(290,600a,600, C270), 161+(290,C270), 227ca+(600, C270,DME,600a,290),227ea+(600,C270, 600a,290) | (US047) |
| 86 | USP6,013,194(2000) | Minor | 236ca+(600,C270,600a,290), 236cb+ (600,C270,DME,600a,290),236ea+(600, C270,DME,600a,290),236fa+(600,C270, DME,600a,290) | (US048) |